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ANNUAL REPORT
IOWA WEATHER AND CROP SERVICE
1918

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In Co-operation with the

IOWA WEATHER AND CROP SERVICE

Annual Report for 1918

CHARLES D. REED, M. Sc. Agr.

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LETTER OF TRANSMITTAL.

HON. W. L. HARDING, *Governor*.

SIR: In compliance with the requirements of the law, I have the honor to submit herewith the twenty-ninth annual report of the Iowa Weather and Crop Service for the year 1918.

CHARLES D. REED, *Director*.

Des Moines, Iowa, June 15, 1919.

HISTORICAL DATA.

The Iowa Weather and Crop Service was established by an Act passed by the Twenty-third General Assembly, and approved by the Governor April 25, 1890.

The object of the Service is to cooperate with the U. S. Weather Bureau in collecting crop statistics and meteorological data, and more widely disseminate the weather forecasts and storm and frost warnings for the producers and shippers of perishable products, and to promote general knowledge of meteorological science and the climatology of the State.

In accordance with the Act, on the recommendation of the directors of the State Agricultural Society, J. R. Sage was duly commissioned as director by Governor Boies on June 3, 1890, and General Greeley, then Chief Signal Officer, U. S. Army, detailed Dr. George M. Chappel to serve as assistant director of the State Service. Mr. J. R. Sage resigned as director December 31, 1907, and Dr. George M. Chappel was commissioned on January 1, 1908, as director, and served in that capacity till March 31, 191⁴~~9~~ when he resigned and was succeeded by Charles D. Reed.

OFFICE FORCE, DECEMBER 31, 1918.

Charles D. Reed, M. Sc. Agr., Director.

Fred L. Disterdick, Meteorologist and First Assistant.

Ed. W. McGann and Ethel D. Slaght, Assistants.

Ruby C. Sage, Stenographer and Statistician.

Horace C. Burgum, Apprentice.

ANNUAL REPORT, 1918.

For convenient reference and comparison with past and future years, this report contains the summaries of the monthly and weekly bulletins of the Iowa Weather and Crop Service in cooperation with the Weather Bureau of the United States Department of Agriculture for the year 1918.

The regular meteorological, climatological and crop statistical work of the Service was maintained at as high a standard of efficiency as possible with the frequent changes in personnel, due to war causes and the lack of trained assistance. The changes in personnel were numerous among the cooperative observers and crop correspondents. Resignations and deaths resulted in closing a few stations.

Increased cost of publication caused considerable curtailment of mailing lists to keep within the appropriation, which has remained the same for more than 20 years. Sixteen thousand copies of the monthly Climatological Reports, and 22,500 copies of the Weather-Crop Bulletins were distributed during the year. Five hundred copies of the monthly reports are distributed each month through the Weather Bureau, U. S. Department of Agriculture, to scientific Institutions and libraries in this and foreign countries.

The daily weather forecasts were distributed by telegraph at the expense of the U. S. Weather Bureau to 78 towns, by franked mail to 1,918 addresses, by rural delivery to 819 addresses, and by free telephone to 131,272 subscribers. Frost warnings are sent, in case of necessity, during the fruit blooming season, to all orchardists in the State who are prepared to use orchard heaters in case of frost or injurious temperatures.

CLIMATOLOGY OF THE YEAR 1918.

The mean temperature, 49.2° , is 1.8° above normal. All months were warmer than normal, except January, April, July and September which were deficient in temperature. The highest temperature, 113° , at Clarinda, on August 4, equaled the 29-year record for the State. The period, July 25 to August 13, was abnormally dry and hot and caused serious damage to the corn crop, particu-

larly over the southwest one-third of the State. The total precipitation averaged 32.78 inches, or 0.81 inch above normal. The precipitation was considerably in excess of normal in the north-central counties and markedly deficient in Pottawattamie and adjoining counties.

The season advanced rapidly in the spring, harvest began about 10 days early and conditions were favorable for all crops till the heat and drouth period above mentioned. Though September was cold, dry and unfavorable for fall seeding, a large acreage of wheat was seeded, and favorable conditions in the other fall months caused wheat and rye to make good growth and enter the winter in excellent condition. Corn was of excellent quality; 90 per cent was husked by December 1 and nearly all by the close of the year. Very little was marketed because of unusually bad roads. Generally favorable weather in all seasons, offset in large measure, the labor shortage, due to the war.

Barometer (reduced to sea level). The average pressure of the atmosphere for the year was 30.01 inches. The highest pressure was 31.07 inches, at Sioux City, on February 21st. The lowest pressure was 29.02 inches, at Charles City, on February 14th. The range for the State was 2.05 inches.

Temperature. The mean temperature for the State was 49.2° or 1.8° above the normal. The highest annual mean was 53.1°, at Keokuk, Lee County. The lowest annual mean was 45.0° at Estherville, Emmet County. The highest temperature reported was 113°, at Clarinda, Knoxville and Shenandoah, on August 4th. The range for the State was 149°.

Precipitation. The average amount of rainfall and melted snow for the year was 32.78 inches, or 0.81 inches more than the normal, and 4.97 inches more than the average for 1917. The greatest amount at any station was 47.53 inches, at Nora Springs, Floyd County, and the least amount was 21.44 inches, at Omaha, Nebr. The greatest monthly precipitation was 11.98 inches, at Gilman, Marshall County, in May. The least amount was a trace, at Harlan in the Central Division in March. The greatest amount in any 24 consecutive hours was 5.37 inches, at Monroe, on June 24th. Measurable precipitation occurred on an average of 92 days, 10 days more than in 1917.

Snowfall. The average amount of snowfall was 33.6 inches. The greatest amount reported from any station was 55.5 inches at Lacona, Warren County, and the least amount was 17.8 inches at Rock Rapids, Lyon County. The greatest monthly snowfall was 27.8 inches at Le Claire, Scott County, in January.

Wind. The prevailing direction of the wind was southwest. The highest velocity reported was 60 miles an hour from the west at Sioux City, Woodbury County, on May 9th.

Sunshine and Cloudiness. The average number of clear days was 173; partly cloudy, 97; cloudy, 95; as against 171 clear; 98 partly cloudy, and 96 cloudy days in 1917. The average percentage of the possible amount of sunshine was 61 or about normal.

MONTHLY SUMMARIES.

JANUARY.

January, 1918, was severely and almost continuously cold—only January, 1912, being colder. The mean temperature of the 62-day period, December 1, 1917 to January 31, 1918, 11.6° is the coldest of the 28 similar periods since statewide records began, and 2.5° colder than the former record period, December, 1892-January, 1893. The deficiencies in temperature for January were greatest in the southeastern and west-central counties. Precipitation, mostly snow, averaged about normal for the State, but was excessive in some of the Mississippi River counties and deficient in portions of Boone, Carroll, Dallas and Guthrie counties and southwest to the boundaries of the State. The ground was snow-covered, continuously over about the eastern one-third of the State, less than 20 days in Crawford, Carroll, Greene and Boone counties, and less than 10 days toward the close of the month over most of Boone county.

The condition of winter wheat has not changed much, being fair in the southeastern counties and varying much in small adjacent areas in other sections. With the prevailing methods of culture, wheat fields were generally blown bare of snow by the winds, though the surrounding country remained snow-covered. About 8 per cent of the corn is still unhusked. Cold and snowy weather impeded rail traffic; and because of the car shortage, little corn was shelled. Live stock is generally reported in good condition, though fed to capacity on the soft corn which has little more than half the usual feeding value.

Pressure. The mean pressure (reduced to sea level) for the State was 30.03 inches. The highest recorded was 30.82 inches, at Sioux City, on the 31st, and the lowest was 29.34, at Dubuque, on the 12th. The monthly range was 1.48 inches.

Temperature. The mean temperature for the State, as shown by the records of 97 stations, was 8.6° , or 9.3° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 5.9° , or 8.7° lower than the normal; Central, 8.9° , or 9.3° lower than the normal; Southern, 11.1° , or 9.8° lower than the normal. The highest monthly mean was 14.2° , at Northboro, and the lowest monthly mean was 2.2° at Estherville. The highest temperature reported was 53° , at Thurman, on the 1st, and at Northboro, on the 24th, and the lowest temperature reported— 35° at Washta on the 31st. The temperature range for the State was 88° .

Humidity. The average relative humidity for the State at 7 a. m. was 85 per cent, and at 7 p. m. it was 79 per cent. The mean for the month was 82 per cent, or about 1 per cent more than normal. The highest monthly mean was 88 per cent at Charles City, and the least was 75 at Omaha, Nebr.

Precipitation. The average precipitation for the State, as shown by the records of 102 stations, was 1.02 inches, or 0.03 inch less than the normal. By divisions the averages were as follows: Northern, 1.04 inches, or 0.20 inch more than the normal; Central, 1.10 inches, or 0.01 inch less than the normal; Southern, 0.91 inch, or 0.28 less than the normal. The

greatest amount, 2.79 inches, occurred at Le Claire, and the least, 0.26 inch, at Northboro. The greatest amount in any 24 consecutive hours, 1.00 inch, occurred at Fairfield, on the 6th, and at Nora Springs on the 27th.

Snow. The average snowfall for the state was 11.2 inches, or 4.3 inches above the normal. The greatest amount, 27.8 inches, occurred at Le Claire, and the least, 3.0 inches, at Creston.

Wind. The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 46 miles an hour from the northwest, at Sioux City, on the 23rd.

Sunshine and Cloudiness. The average percentage of the possible amount of sunshine was 53, or about 3 per cent higher than the normal. The percentage of the possible amount at the several regular Weather Bureau stations was as follows: Charles City, 37; Davenport, 55; Des Moines, 57; Dubuque, 60; Keokuk, 52; Omaha, Nebr., 61; Sioux City, 50. Clear days averaged 13; partly cloudy days, 8; cloudy, 10.

Miscellaneous Phenomena. Aurora, observed at Allison and Nora Springs on 30th. Fog, 1st, 3d, 5th, 8th, 10th, 11th, 20th, 22d, 29th, 30th. Hail, 23d, 24th. Halos (lunar or solar), 1st, 4th, 9th, 11th, 12th, 15th, 17th, 18th, 22d, 25th, 29th, 30th, 31st. Haze, 2d, 3d, 4th. Meteor (brilliant), observed at Atlantic, Corning, Corydon, Des Moines, Earlham, Glenwood, Indianola, Lamoni, Mason City, Mt. Ayr, Washta and Winterset on the 22d (see article on page 9 relative thereto). Parhelia, 8th, 9th, 11th, 12th, 16th, 17th, 18th, 26th. Sleet, 1st, 2d, 5th, 23d, 24th, 26th, 30th; at scattered stations.

COMPARATIVE DATA FOR THE STATE—JANUARY.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	19.7	+ 1.8	61	—27	2.03	+0.98	3.46	0.35	-----				
1891-----	26.0	+ 8.1	58	— 4	1.75	+0.70	3.99	0.61	-----	4	13	7	11
1892-----	15.3	— 2.6	76	—38	1.09	+0.04	3.13	0.10	6 9	5	16	9	6
1893-----	9.3	— 8.6	54	—34	0.74	—0.31	3.20	0.13	6.9	6	11	9	11
1894-----	19.3	+ 1.4	69	—37	1.09	+0.04	2.24	0.31	6.0	5	14	9	8
1895-----	13.6	— 4.3	63	—31	0.85	—0.20	2.65	0.09	8.7	4	15	7	9
1896-----	23.4	+ 5.5	68	—20	0.48	—0.57	2.10	T.	2.3	3	10	10	11
1897-----	17.2	— 0.7	66	—30	2.01	+0.96	6.16	0.15	8.2	7	12	7	12
1898-----	23.4	+ 5.5	52	—11	1.60	+0.55	5.32	T.	12.6	5	15	6	10
1899-----	19.8	+ 1.9	68	—34	0.28	—0.77	1.15	T.	1.5	3	15	10	6
1900-----	25.6	+ 7.7	66	—20	0.53	—0.52	2.47	T.	2.3	3	16	7	8
1901-----	23.7	+ 5.8	60	—21	0.74	—0.31	2.34	0.04	6.2	4	14	9	8
1902-----	22.4	+ 4.5	63	—31	0.88	—0.17	2.83	0.19	9.4	4	17	8	6
1903-----	23.0	+ 5.1	60	—12	0.28	—0.77	1.46	T.	2.0	4	13	7	11
1904-----	14.0	— 3.9	57	—32	1.18	+0.13	3.68	0.02	6 1	6	12	8	11
1905-----	11.2	— 6.7	56	—30	0.91	—0.14	1.82	0.12	11.1	7	14	7	10
1906-----	24.6	+ 6.7	69	—19	1.52	+0.47	4.71	0.28	11.3	5	14	6	11
1907-----	18.8	+ 0.9	63	—22	1.52	+0.47	5.30	0.10	6.0	7	8	7	16
1908-----	24.9	+ 7.0	60	—18	0.44	—0.61	1.50	0.06	4 6	2	17	8	6
1909-----	21.2	+ 3.3	72	—25	1.66	+0.61	3.74	0.41	7.8	6	9	6	16
1910-----	18.1	+ 0.2	56	—35	1.57	+0.52	3.15	0.55	12.6	6	13	7	11
1911-----	20.2	+ 2.3	66	—35	0.97	—0.08	3.73	0.11	7.3	5	9	8	14
1912-----	4.2	—13.7	49	—47	0.53	—0.52	1.90	T.	5.5	5	14	7	10
1913-----	20.9	+ 3.0	62	—25	0.77	—0.28	2.05	0.04	7.2	5	14	9	8
1914-----	27.8	+ 9.9	64	—10	0.88	—0.17	2.34	0.27	5.1	5	11	8	12
1915-----	17.5	— 0.4	59	—32	1.63	+0.53	3.15	0.10	7.3	8	13	8	10
1916-----	17.8	— 0.1	63	—34	2.62	+1.57	6.07	0.85	7.2	10	12	6	13
1917-----	17.0	— 0.9	60	—28	0.83	—0.22	2.07	0.17	7.2	4	17	8	6
1918-----	8.6	— 9.3	53	—35	1.02	—0.03	2.79	0.26	11.2	7	13	8	10

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

BRILLIANT METEOR OF JANUARY 22, 1918.

By D. W. Morehouse, Ph. D., Drake University, Des Moines, Iowa.

On January 22, about 6 p. m. central standard time, a very brilliant meteor passed over the western portions of Iowa and Missouri. About thirty observations which seemed to contain definite and reliable information were collected in Iowa, Missouri, Kansas and Nebraska, including notes made by cooperative observers of the Weather Bureau in Iowa. It appears from these data that the meteor moved in a general direction from north to south bearing slightly toward the east; that its path was at a considerable height; and that the place of its disappearance is not far from St. Joseph, Mo. Reports from Mason City, Ia., describe the meteor as very bright and appearing a little west of south. A report from Washta bears the same statement, except that it was then seen in the south. A fragment is reported to have fallen on the farm of Rudolph Peterson, three miles north of Creston, Ia. While the description is scientifically untenable, it has some appearance of genuineness. The statement is that, "It could not be approached for over 24 hours because it was so hot. It was about the size of a bushel basket. The segment (fragment) has the appearance of pumicestone and is apparently porous. There are particles of iron in the stone."

At Lamoni, Ia., the meteor was described as falling in the northwest, followed by several heavy rolls of thunder. At Baxter, it is reported that two falling stars were seen to cross the sky. Rockwell City reports that "The glare from a meteor passing through the sky in the north Tuesday evening frightened a team of horses hitched to a hayrack, causing a runaway." The farthest north from which there is any authentic report of a noise, is Mt. Ayr, Ia. The statement written to me personally from a former student is, "It was first seen coming from the north and west of this immediate vicinity. Just before it vanished from view it seemed to be much redder and looked to be going down. In just about 10 minutes after we saw the meteor we heard a report as though a large shot gun had been discharged at a distance of about a quarter of a mile. Immediately following the report we experienced a shock that rattled our doors and windows. The people of Mt. Ayr also experienced the shock, though not the report. Our first neighbor south also heard the report and felt the shock in about 10 minutes."

From St. Joseph, Mo., the report is that "A small piece of the meteor hit the earth just east of the city limits at the home of Richard Tarwater. It struck in the yard close to the house, according to members of the family, and imbedded itself in the ground." "There was a brilliant light lasting about 30 seconds but no noise," reported Mr. Tarwater. The most southern point reporting the meteor to date, is Coffeyville, Kans., where it is described as "Giving a lurid glare and passing from the west toward the east, striking seemingly just north of town with such force that the windows in the city rattled to such an extent that the people ran out thinking an explosion had occurred." At Richmond, Mo., it was reported that "The vivid white ball of fire traveling across the northern sky appeared to burst high in the air and the fragments were consumed before they reached the earth." Fragments were also reported from Albany, Mo. The usual thin cloud of dust marking the trail of the meteor high in the sky was noted by practically every observer, but none reports any drift showing the movement of the higher air.

FEBRUARY.

February opened severely cold with the ground heavily snow-covered. Most stations reported their lowest temperatures of the winter on either the first or the 4th. Temperatures began to moderate on the 5th; the snow disappeared, except in some northern counties by the 10th; and the remainder of the month was mild, except cold waves, 16th-17th and 19th-21st, with occasional moderate snows that soon disappeared. Temperatures averaged above normal, except in Cass, Black Hawk and Clayton counties. Average daily excesses of 4° or more were reported from Buena Vista, Kossuth, Taylor and Van Buren counties.

On the 8th, a sleet storm, attended by lightning and thunder, covered a belt 100 or more miles wide, extending from southwest to northeast across the State. In portions of this belt a glaze formed, the central and southwestern portions being without snow covering. On the 14th, glaze covered Guthrie, Greene and Dallas counties and northeast nearly to the boundaries of the State, mostly without prior snow covering. The

ground was snow-covered 25 or more days in the extreme north-central and northeast portions, and less than 10 days generally in the southern tier of counties and northward over Clarke, Lucas, Madison, Guthrie, Dallas and Greene counties. Snow covering was general at the close of the month.

Deficiencies of 1 inch or more in precipitation occurred in Kossuth and Fayette counties; while excesses, mostly snow, extended from the southwest to the east-central counties.

Mild weather toward the close of the month improved fuel and transportation conditions and corn began to move. Some corn remains unhusked in the fields. Winter wheat is reported as small but promising in the southeastern and uncertain in the southwestern portions of the State. Large areas that remained ungerminated because of drought last fall, are being watched with great interest.

Pressure. The mean pressure (reduced to sea level) for the State was 30.06 inches. The highest recorded was 31.07 inches, at Sioux City, on the 21st, and the lowest was 29.02 at Charles City on the 14th. The monthly range was 2.05 inches.

Temperature. The mean temperature for the State, as shown by the records of 103 stations, was 23.0° , or 2.5° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 19.3° , or 2.2° higher than the normal; Central, 23.1° , or 2.4° higher than the normal; Southern, 26.7° , or 3.1° , higher than the normal. The highest monthly mean was 29.8° at Keokuk, and the lowest monthly mean was 15.2° at Estherville. The highest temperature reported was 70° , at Clarinda, on the 23d, and the lowest temperature reported was -36° , at Washta, on the 4th. The temperature range for the State was 106° .

Humidity. The average relative humidity for the State at 7:00 a. m. was 82 per cent, and at 7:00 p. m. it was 73 per cent. The mean for the month was 78 per cent, or about 1 per cent lower than the normal. The highest monthly mean was 84 per cent, at Charles City, and the lowest was 71 at Omaha, Nebr.

Precipitation. The average precipitation for the State, as shown by the records of 111 stations, was 0.95 inch, or 0.20 inch less than the normal. By divisions, the averages were as follows: Northern, 0.52 inch, or 0.39 inch less than the normal; Central, 1.13 inches, or 0.07 inch less than the normal; Southern, 1.20 inches, or 0.15 inch less than the normal. The greatest amount, 2.10 inches, occurred at Olin, and the least, 0.09 inch, at Algona. The greatest amount in any 24 consecutive hours, 1.22 inches, occurred at Monroe on the 8th.

Snow. The average snowfall for the State was 6.0 inches, or 1.4 inches less than the normal. The greatest amount, 14.5 inches, occurred at Glenwood, and the least, 0.5 inch at Keokuk.

Wind. The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was 51 miles an hour from the northwest at Sioux City on the 25th.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 62, or about 7 per cent more than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 49; Davenport, 63; Des Moines, 59; Dubuque, 64; Keokuk, 61; Sioux City, 73; Omaha, Nebr., 64.

Miscellaneous Phenomena. Aurora, observed at Inwood on the 10th; Allison and Nora Springs on the 12th; and Waukee on the 19th. Birds (migration of), Bedford, blue birds and ducks on the 26th; Corydon, robins on the 7th; Earlham, blue birds and ducks on the 14th. Fog, 6th, 7th, 8th, 9th, 10th, 14th, 17th, 18th, 19th. Hail, 5th, 8th, 14th, 19th. Halo (lunar or solar), 1st, 3d, 4th, 11th, 12th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22d, 23d, 24th. Haze, 18th. Parhelia, 1st, 2d, 19th, 20th. Sleet, 6th, 8th, 14th, 27th. Thunderstorms, 8th, 13th, 25th, 28th.

THE WINTER OF 1917-1918.

The mean temperature for the three winter months was 15.4° , which is 5.4° below the normal for the State, and only 0.5° warmer than the coldest of the 28 winters of record, 1892-93. The highest temperature reported was 70° at Clarinda, Page County, on February 23d. The lowest temperature reported was 40° below zero at Washta, Cherokee County, on December 29th.

The average monthly precipitation for the State was 0.84 inch, and the average total precipitation was 2.53 inches, or 0.89 inch less than the winter normal. The average total snowfall, unmelted, was 23.9 inches, or 3.4 inches more than the normal and 6.5 inches more than the average fall for the winter of 1916-17.

The total number of days with .01 inch or more of precipitation was 18, or 5 more than the average for the winter of 1916-17. The average number of clear days was 37, partly cloudy 24, cloudy 29, as compared with 46 clear, 24 partly cloudy and 20 cloudy days during the winter of 1916-17.

COMPARATIVE DATA FOR THE STATE—FEBRUARY.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	26.0	+ 5.5	67	—24	0.83	—0.32	2.18	0.11	-----	-----	-----	-----	-----
1891-----	19.4	— 1.1	70	—31	1.16	+0.01	2.41	0.55	-----	3	13	7	8
1892-----	28.1	+ 7.6	68	—20	1.20	+0.05	2.18	0.12	5.0	6	6	7	16
1893-----	16.4	— 4.1	60	—28	1.39	+0.24	2.91	0.06	8.1	6	10	8	10
1894-----	19.7	— 0.8	60	—19	0.89	—0.26	2.41	T.	8.4	3	16	8	4
1895-----	16.4	— 4.1	73	—33	0.49	—0.66	1.34	0.02	3.3	4	13	9	6
1896-----	27.4	+ 6.9	78	—13	0.71	—0.44	2.40	0.04	5.4	4	12	9	8
1897-----	24.7	+ 4.2	61	—24	0.89	—0.26	1.81	0.22	8.0	5	6	10	12
1898-----	24.2	+ 3.7	62	—18	1.20	+0.05	3.65	0.10	7.8	5	10	9	9
1899-----	12.2	— 8.3	75	—40	0.89	—0.26	4.32	0.12	7.1	5	11	10	7
1900-----	14.8	— 5.7	60	—27	1.30	+0.15	4.57	0.18	9.9	6	10	8	10
1901-----	17.5	— 3.0	49	—21	1.01	—0.14	3.00	0.12	9.7	4	15	7	6
1902-----	17.6	— 2.9	62	—21	0.73	—0.42	2.39	0.02	2.6	4	13	8	7
1903-----	19.8	— 0.7	56	—21	1.18	+0.03	3.25	0.30	7.9	4	13	7	8
1904-----	14.8	— 5.7	70	—26	0.41	—0.74	1.99	T.	4.5	4	10	9	10
1905-----	12.8	— 7.7	69	—41	1.57	+0.42	2.97	0.44	15.5	7	14	6	8
1906-----	23.6	+ 3.1	66	—32	1.29	+0.14	2.91	0.20	6.1	5	14	7	7
1907-----	25.0	+ 4.5	65	—31	0.71	—0.44	1.95	0.06	4.6	4	14	6	8
1908-----	24.3	+ 3.8	59	—16	1.69	+0.54	3.95	0.23	8.9	6	12	6	11
1909-----	26.2	+ 5.7	62	—26	1.54	+0.39	4.72	0.30	7.7	5	11	6	11
1910-----	17.8	— 2.7	58	—21	0.46	—0.69	2.09	T.	4.0	3	14	8	6
1911-----	27.3	+ 6.8	71	—13	2.76	+1.61	5.46	0.50	7.0	6	12	6	10
1912-----	18.1	— 2.4	57	—30	1.21	+0.06	3.25	0.04	11.2	5	10	9	10
1913-----	20.2	— 0.3	70	—24	0.82	—0.33	2.39	0.07	7.3	4	14	7	7
1914-----	16.8	— 3.7	59	—29	0.87	—0.28	1.99	0.32	9.2	6	10	9	9
1915-----	29.1	+ 8.6	62	— 8	2.93	+1.78	5.39	0.43	9.4	9	9	5	14
1916-----	19.0	— 1.5	62	—32	0.55	—0.60	1.38	0.05	6.0	4	14	8	7
1917-----	15.2	— 5.3	68	—37	0.36	—0.79	1.19	T.	3.5	3	14	8	6
1918-----	23.0	+ 2.5	70	—36	0.95	—0.20	2.10	0.09	6.0	5	14	7	7

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

MARCH.

March was abnormally warm, the largest excesses in temperature, 12 degrees daily, being in Crawford County, and the smallest excesses, 7 or 8 degrees, being in the northeastern counties. Frost left the ground early in the month, not having penetrated deeply during the winter. Precipitation was in excess of the normal in the northern tier of counties, but very deficient over the southern half of the State except the extreme southeastern counties. Heavy snow fell in the northeastern part of the State on the 13th-14th. Further south along the Mississippi River this was a heavy rainstorm. Dubuque had 0.84 inch in one hour and 1.65 inches in 24 hours, being the largest amounts in the State for those periods. A glaze storm on the 9th damaged telephone and telegraph wires in the northern part of the State to the amount of \$50,000.

At the close of the month the season was two weeks earlier than usual; soil dry but working up in fine condition; seeding of spring wheat and oats completed in the south and progressing rapidly in the north; and the husking of the remnant of the 1917 corn crop was practically finished. The acreage of spring wheat is remarkably large and would be larger but for the shortage of cars in which to ship seed. Fall wheat wintered well, especially in the southeastern counties, but badly needed rain; some that

failed to germinate last fall, germinated in March. The mild, dry weather was especially favorable for the lamb and pig crop.

Pressure. The mean pressure (reduced to sea level) for the State was 30.03 inches. The highest recorded was 30.71 inches, at Sioux City, on the 15th; and the lowest was 29.12 inches, at Des Moines, Ia., and Omaha, Nebr., on the 9th. The monthly range was 1.59 inches.

Temperature. The mean temperature for the State, as shown by the records of 100 stations, was 42.9°, or 9.6° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 40.0°, or 9.5° higher than the normal; Central, 43.1°, or 9.5° higher than the normal; Southern, 45.6°, or 9.7° higher than the normal. The highest monthly mean was 47.8° at Northboro and the lowest monthly mean was 36.8°, at Elkader. The highest temperature reported was 85°, at Denison, on the 19th. The lowest temperature reported was zero, at Sibley, on the 10th.

Humidity. The average relative humidity for the State at 7 a. m. was 74 per cent, and at 7 p. m. it was 51 per cent. The mean for the month was 63 per cent, or about 10 per cent lower than the normal. The highest monthly mean was 72 per cent, at Charles City, and the lowest was 55 at Omaha. Very low humidity prevailed after the 15th. On the 18th at Omaha 8 per cent at 7 p. m., at Des Moines 5 per cent at 2 and 3 p. m., and at Keokuk 14 per cent at noon are respectively the lowest ever observed at those stations.

Precipitation. The average precipitation for the State, as shown by the records of 101 stations, was 0.63 inches, or 1.14 inches less than the normal. By divisions the averages were as follows: Northern, 1.12 inches, or 0.41 inch less than the normal; Central, 0.54 inch, or 1.33 inches less than the normal; Southern, 0.23 inch, or 1.69 inches less than the normal. The greatest amount, 2.12 inches, occurred at Dubuque, and the least, a trace, at Harlan. The greatest amount in any 24 consecutive hours, 1.65 inches, occurred at Dubuque on the 13th-14th.

Snow. The average snowfall for the State was 2.6 inches, or 2.7 inches less than the normal. The greatest amount, 15.5 inches, occurred at Northwood; Burlington, Fort Madison, Lacona and Oskaloosa reported no snow, and 18 stations reported only a trace.

Wind. The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 52 miles an hour from the southwest, this occurring at Keokuk on the 9th.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 73, or about 16 per cent higher than the normal. The per cent of the possible amount at the regular Weather Bureau station was as follows: Charles City, 65; Davenport, 72; Des Moines, 77; Dubuque, 76; Keokuk, 68; Sioux City, 77; Omaha, Nebr., 76.

Miscellaneous Phenomena. Aurora, 7th, 8th, 9th. See special article, page 15. Birds (migration of), Corydon, ducks on the 8th; Earlham, black birds on the 9th; Baxter, robins on the 11th; Boone, robins on the 4th; Nora Springs, wild geese and robins on the 18th, black birds on the 20th,

meadow larks on the 22d; Postville, robins on the 11th, blue birds on the 12th; Des Moines, robins on the 4th, wild geese on the 14th and blue birds on the 23d. Fog, 4th, 5th, 6th, 9th, 13th, 14th, 21st, 30th. Glaze, 9th. Hail, 9th, 13th. Halo (lunar or solar), 5th, 9th, 13th, 14th, 22d, 25th, 27th, 28th, 29th. Haze, 12th, 19th, 20th, 21st, 22d. Sleet, 7th, 8th, 9th, 13th, 14th. Thunderstorms, 9th, 13th, 14th, 21st, 22d.

Rivers. The rivers and streams broke up and ran out quietly, in the southern part of the State near the close of February, in the central part about the 6th of March, and in the northern part about the 18th. The breaking up of the upper Missouri River caused stages within about 1.5 feet of flood stage at Iowa points on that river toward the close of the month.

AURORA OF MARCH 7, 1918.

One of the most spectacular displays of the aurora borealis ever observed in this State occurred on the night of March 7th. Newspapers report the display in nearly all portions of the United States and in northern Europe. At Des Moines it became noticeable about 7:20 p. m. in the form of an arch of light in the northern sky at an altitude of about 25°. This rapidly enlarged, became brighter and rose to an altitude of 60° by 8 p. m., the width of the arch being about 20° and extending from the eastern to the western horizons. About this time the flickering streamers of light known as "merry dancers" began to appear; also vivid colors, green predominating in the north and northeast and crimson in the northwest. About 9 p. m. large areas of light appeared in the south and gradually formed a continuous arch of light at an altitude of about 30°, known as the "auroral corona." At 9:30 p. m. the entire heavens were ablaze with hues and shafts of light that rapidly changed into forms of endless variety, the predominating thing being shafts of whiter light that rose from the horizon at nearly all points except a small arc in the south, and converged at a point a little, possibly 10°, southwest of the zenith. About 10:30 p. m. the display began to diminish, but some signs of it remained as late as 1:30 a. m. of the 8th. At times the light of the aurora was nearly equal to that of the full moon. Telegraph service was much troubled by the magnetic effects of the aurora.

Similar descriptions were received from observers in all portions of the State. Mr. J. H. Spencer, Meteorologist, Weather Bureau, Dubuque, Iowa, adds: "Another prominent feature was the many distinct patches or groups of light, resembling thin, whitish clouds. They were most numerous overhead and looked like cirro-stratus clouds of irregular shape. There was a decided contrast between the clear sky and the cloud-like patches. Where there were no patches the stars shone with much brilliancy, but through the cloud-like patches the stars shone only faintly."

Prof. J. L. Tilton, Simpson College, Indianola, Iowa, states that, "Overhead was what appeared to be a faint grayish cloud forming a band about half way across the sky from east to west. This band slowly drifted southward and faded away when across Orion. * * * * * If this was a cloud it seemed related to the aurora in cause. Other bands of a similar character appeared with some degree of regularity, several of them com-

pletely arching the sky from east to west, all traveling slowly, almost imperceptibly, toward the south, some not fading away till within 15 or 20 degrees above the southern horizon. These moving patches and arches were visible all through the evening, even when the white streamers met overhead. For a time three parallel bands were in sight, each requiring half to three-quarters of an hour to move from the zenith to beyond Orion."

COMPARATIVE DATA FOR THE STATE—MARCH.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	28.0	— 5.3	75	—24	1.57	—0.20	3.67	0.32	-----	-----	-----	-----	-----
1891-----	26.8	— 6.5	66	—19	2.60	+0.83	4.58	1.33	-----	10	6	8	17
1892-----	31.9	— 1.4	84	— 6	2.22	+0.45	4.58	0.57	3.9	6	11	8	12
1893-----	31.8	— 1.5	84	— 8	2.14	+0.37	4.40	0.64	4.0	8	9	11	11
1894-----	41.0	+ 7.7	84	— 5	2.03	+0.26	4.52	0.26	2.7	6	13	10	8
1895-----	34.4	+ 1.1	94	—11	0.83	—0.94	2.60	0.22	2.9	4	16	8	7
1896-----	30.9	— 2.4	81	—12	1.10	—0.67	3.99	0.16	5.4	5	12	9	10
1897-----	32.0	— 1.3	72	—22	2.39	+0.62	6.16	0.29	5.5	8	9	8	14
1898-----	37.5	+ 4.2	72	— 2	1.94	+0.17	6.21	0.33	3.7	6	12	9	10
1899-----	23.0	—10.3	75	—16	1.62	—0.15	5.90	0.37	8.0	6	7	12	12
1900-----	30.7	— 2.6	81	—13	2.06	+0.29	5.15	0.45	6.6	5	12	9	10
1901-----	34.2	+ 0.9	76	— 8	2.64	+0.87	5.25	0.70	12.6	7	10	8	13
1902-----	39.1	+ 5.8	79	—12	1.45	—0.32	4.33	0.13	1.3	7	9	11	11
1903-----	38.8	+ 5.5	82	6	1.38	—0.39	3.90	0.15	3.9	7	11	7	13
1904-----	34.8	+ 1.5	78	3	2.18	+0.41	4.57	0.50	4.4	7	8	8	15
1905-----	41.5	+ 8.2	84	1	2.04	+0.27	3.70	0.39	4.1	7	8	8	15
1906-----	27.1	— 6.2	65	—14	2.34	+0.57	4.55	0.58	8.9	10	8	7	16
1907-----	40.6	+ 7.3	92	— 7	1.35	—0.42	5.05	0.23	4.1	6	14	7	10
1908-----	37.9	+ 4.6	85	— 8	1.58	—0.19	3.74	0.45	1.1	6	13	7	11
1909-----	32.5	— 0.8	71	—15	1.53	—0.24	5.00	0.28	9.8	6	12	10	9
1910-----	48.9	+15.6	92	—10	0.17	—1.60	1.32	0.00	T.	1	23	6	2
1911-----	39.4	+ 6.1	83	2	0.93	—0.84	4.84	T.	1.9	5	16	9	6
1912-----	24.9	— 8.4	70	—19	2.01	+0.24	5.25	0.60	19.1	7	15	6	10
1913-----	31.9	— 1.4	78	—23	2.48	+0.71	5.88	0.74	5.3	9	11	10	10
1914-----	34.7	+ 1.4	78	— 5	1.69	—0.08	3.84	0.28	1.8	7	12	8	11
1915-----	29.3	— 4.0	61	— 5	0.96	—0.81	2.12	0.17	8.8	5	8	9	14
1916-----	35.2	+ 1.9	80	—18	1.57	—0.20	5.80	0.23	2.9	6	11	9	11
1917-----	34.6	+ 1.3	85	—12	1.84	+0.07	4.35	0.57	6.2	6	14	8	9
1918-----	42.9	+ 9.6	85	0	0.63	—1.14	2.12	0.03	2.6	3	19	7	5

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

APRIL.

April was colder than normal and less than 2° warmer than March. The deficiency accumulated mainly in the last 12 days, being the greatest, 7.6°, in Decatur County.

Precipitation was quite evenly distributed but generally deficient, though there was a slight excess in several of the eastern counties and in Fremont, Page and Taylor Counties. The deficiency was greatest, about 2 inches, in Madison County. A striking feature was the snowstorm of the 19th-21st, which covered the southern and eastern portions of the State, except the extreme southeast counties. In Page, Taylor, Ringgold and Decatur Counties from one to two feet of snow fell, exceeding the total fall of the winter months just preceding. Such a storm is believed to be

unprecedented so late in the season, though a snowstorm of slightly less intensity occurred in south-central Iowa on April 7, 1917.

All vegetation made slow progress. Spring seeded grains depended largely on subsoil moisture till the middle of the month after which temperatures were too low, so that germination was very uneven; some that was seeded more than a month before was scarcely showing green at the end of the month over much of the State. Pears and plums were in full bloom in the southern counties near the close of the month. Field work progressed rapidly with the soil in excellent condition. Eighty-five per cent of the corn ground was made ready for the planter and a little planting was done in the south. Seed corn is generally scarce and of low vitality. Winter wheat, pastures and meadows suffered from drouth, cold and high winds.

Pressure. The mean pressure (reduced to sea level), for the State was 30.01 inches. The highest recorded was 30.78 inches, at Dubuque, on the 9th, and the lowest was 29.23 inches at Charles City, on the 29th. The monthly range was 1.55 inches.

Temperature. The mean temperature for the State, as shown by the records of 106 stations, was 44.8°, or 3.9° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 43.5°, or 3.2° lower than the normal; Central, 45.0°, or 3.9° lower than the normal; Southern 45.9°, or 4.7° lower than the normal. The highest monthly mean was 47.6°, at Northboro, and the lowest was 41.5°, at Decorah. The highest temperature reported was 79°, at Corydon and Fayette, on the 1st, and the lowest was 12° at Lake Park, on the 8th. The temperature range for the State was 67°.

Humidity. The average relative humidity for the State at 7 a. m. was 72 per cent; and at 7 p. m. it was 53 per cent. The mean for the month was 62 per cent, or about 5 per cent below the normal. The highest monthly mean was 74 per cent, at Charles City, and the lowest was 62 per cent, at Sioux City.

Precipitation. The average precipitation for the State, as shown by the records of 113 stations, was 2.32 inches, or 0.54 inch less than the normal. By divisions the averages were as follows: Northern, 1.93 inches, or 0.75 inch less than the normal; Central, 2.31 inches, or 0.55 inch less than the normal; Southern, 2.32 inches, or 0.54 inch less than the normal. The greatest amount, 4.20 inches, occurred at Olin, and the least, 1.01 inches, at Humboldt. The greatest amount in any 24 consecutive hours, 1.80 inches, occurred at Lamoni on the 21st.

Snowfall. The average snowfall for the State was 3.5 inches, or 1.7 inches more than the normal. The averages by divisions were: Northern, 1.0 inch; Central, 2.5 inches; Southern, 7.0 inches. The greatest amount, 24.0 inches, occurred at Bedford.

Wind. The prevailing direction of the wind was from the northeast. The highest velocity reported from a regular Weather Bureau station was at the rate of 59 miles an hour from the northwest at Sioux City on the 29th.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 60, or about normal. The per cent of the possible amount

at the regular Weather Bureau stations was as follows: Charles City, 65; Davenport, 62; Des Moines, 60; Dubuque, 58; Keokuk, 56; Sioux City, 58; Omaha, Nebr., 59. Clear days averaged 12; partly cloudy 8; cloudy, 10.

Rivers. All of the rivers fell almost steadily throughout the month. The Missouri River was rather high at the beginning but became moderate to low. At the close of the month the Mississippi was unusually low for April.

Miscellaneous Phenomena. Aurora, 5th, 10th, 29th, 30th. Fog, 10th, 18th, 22d, 24th, 27th. Hail, Northern Division, 2d, 17th, 28th; Central Division, 2d, 18th, 20th; Southern Division, 2d, 3d, 17th, 19th 20th. At Belmond, moderate hail totaling 0.4 inch in depth occurred on the 17th; no damage. Halo (lunar or solar), 1st, 4th, 5th, 18th, 24th, 25th, 26th, 27th. Haze, 9th, 22d, 25th. Sleet, 2d, 3d, 17th, 18th, 19th, 20th, 21st, 23d, 28th. Thunderstorm, 2d, 3d, 6th, 12th, 13th, 15th, 16th, 17th, 18th, 20th, 21st, 24th, 25th, 27th.

COMPARATIVE DATA FOR THE STATE—APRIL.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890.....	51.8	+3.1	88	2	1.80	−1.06	4.46	0.38	-----	6	14	9	7
1891.....	50.6	+1.9	93	13	2.15	−0.71	5.06	0.59	-----	8	14	7	9
1892.....	45.4	−3.3	88	14	4.75	+1.89	8.33	2.43	5.7	9	8	9	13
1893.....	45.5	−3.2	96	15	4.21	+1.35	8.51	1.24	6.0	10	8	9	13
1894.....	51.7	+3.0	93	12	3.07	+0.21	6.91	0.55	0.2	9	11	11	8
1895.....	54.2	+5.5	98	8	2.62	−0.24	5.88	0.28	2.1	5	14	8	8
1896.....	54.5	+5.8	94	10	5.02	+2.16	9.67	2.35	4.5	11	11	10	9
1897.....	47.9	−0.8	89	19	5.35	+2.49	9.86	2.22	T.	11	9	9	12
1898.....	48.1	−0.6	91	14	2.56	−0.30	4.82	0.27	T.	8	13	9	8
1899.....	48.9	+0.2	89	1	2.40	−0.46	5.76	0.56	2.0	7	12	11	7
1900.....	52.2	+3.5	89	19	2.67	−0.21	6.62	0.43	0.9	6	12	9	9
1901.....	49.9	+1.2	92	15	1.79	−1.07	3.47	0.66	2.0	5	14	8	8
1902.....	48.2	−0.5	96	9	1.71	−1.15	4.15	0.40	T.	5	14	11	5
1903.....	49.8	+1.1	86	17	2.98	+0.12	6.00	0.74	0.8	9	11	9	10
1904.....	44.1	−4.6	86	13	3.63	+0.77	8.97	1.52	1.4	7	15	6	9
1905.....	47.5	−1.2	90	10	3.03	+0.17	5.49	0.63	1.2	8	12	8	10
1906.....	52.5	+3.8	94	22	2.42	−0.44	5.55	0.53	0.6	8	14	9	7
1907.....	41.5	−7.2	80	10	1.32	−1.54	3.22	0.24	2.7	6	12	8	10
1908.....	50.5	+1.8	91	8	2.24	−0.62	4.59	0.67	0.3	8	14	8	8
1909.....	43.8	−4.9	86	14	4.58	+1.72	9.43	0.83	3.1	12	9	9	12
1910.....	52.5	+3.8	99	15	1.48	−1.38	4.86	0.10	3.0	7	14	7	9
1911.....	46.7	−2.0	86	3	3.09	+0.23	6.04	1.33	3.6	9	11	8	11
1912.....	49.9	+1.2	84	20	2.66	−0.20	5.66	0.78	1.1	8	13	8	9
1913.....	50.2	+1.5	88	16	3.28	+0.42	7.43	1.12	2.7	9	15	5	10
1914.....	48.6	−0.1	88	11	2.52	−0.34	5.03	0.37	0.3	8	10	8	12
1915.....	57.2	+8.5	95	18	1.41	−1.45	4.02	0.05	T.	7	15	10	5
1916.....	47.1	−1.6	90	11	2.62	−0.24	5.92	1.13	1.1	10	10	9	11
1917.....	45.5	−3.2	88	17	4.55	+1.69	7.84	2.05	3.8	11	9	7	14
1918.....	44.8	−3.9	79	12	2.32	−0.54	4.20	1.01	3.5	9	12	8	10

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

MAY.

May averaged warm. From freezing temperatures on the 1st the weather turned suddenly hot with maximum temperatures in the 90's in nearly all portions of the State on the 3d and 4th. High southwest winds

and low humidities during this warm period, caused considerable damage to winter wheat, meadows and pastures in the western part of the State. During a cool period, 10th-13th, frost and ice were reported in many sections. Snow and sleet fell in Dallas, Polk, Madison, Warren and Marion Counties on the 13th. The remainder of the month was generally warm. After the first five days precipitation was plentiful except in the south-central and southwest districts where drouth prevailed till the 21st. Toward the close of the month the rains became heavy to excessive but the soil readily absorbed most of the water.

The hay crop will be generally short due to drouth that prevailed till the 6th; winter wheat yields will be much reduced in southwest districts. Corn planting was done under unusually favorable conditions, and in spite of the defective seed, showed a good stand where up. About five per cent of the acreage remained to be planted when the heavy rains suspended planting toward the close of the month.

Tornadoes were remarkably frequent and severe. On the 8th a small one moved northeastward across the southeast corner of Hamilton county, causing \$3,500 damage. On the 9th, one moved from the southwest corner of Chickasaw county northeast into Winneshiek county. An account of this storm, by Mr. H. P. Hardin, Official in Charge, Weather Bureau Office, Charles City, Iowa, begins on page 22. On the same date, one moved from the southwest township in Muscatine county to near the center of Scott county. This storm caused \$40,000 damage in Muscatine county and large damage near Eldridge in Scott county, an account of which is given by Mr. J. M. Sherrier, Official in Charge, Weather Bureau Office, Davenport, Iowa, beginning on page 26. A second tornado visited Eldridge on the 19th, causing 2 deaths, 2 injuries and \$2,000 damage. The 21st was one of the worst tornado days in the history of Iowa, there being five distinct tornado paths, most of them long, on that day. See article, "The Tornadoes of May 21, 1918," beginning on page 28. On the 31st a tornado moved from the central part of Hancock county northeast to north central Worth county, causing \$20,000 damage. The total number of persons killed by tornadoes during the month was 29; total injured, 182; total property damage, \$2,453,780.

Pressure. The mean pressure (reduced to sea level) for the State was 29.91 inches. The highest recorded was 30.43 inches, at Dubuque, on the 23d, and the lowest was 29.09, at Des Moines, on the 9th. The monthly range was 1.34 inches.

Temperature. The mean temperature for the State, as shown by the records of 104 stations, was 64.9°, or 4.4° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 62.8°, or 3.8° higher than the normal; Central, 65.3°, or 4.6° higher than the normal; Southern, 66.7°, or 5.0° higher than the normal. The highest monthly mean was 69.0°, at Ottumwa, and the lowest 58.9°, at Estherville. The highest temperature reported was 98° at Creston, on the 9th, and the lowest was 25° at Audubon, Earlham, Fayette and Guthrie Center, on the 1st. The temperature range for the State was 73°.

Humidity. The average relative humidity for the State at 7 a. m. was 75 per cent, and at 7 p. m. it was 57 per cent. The mean for the month, 66 per cent, is about 1 per cent above the normal. The highest monthly mean was 69 per cent, at Davenport, and the lowest was 62 per cent, at Des Moines.

Precipitation. The average precipitation for the State, as shown by the records of 113 stations, was 6.87 inches, or 2.30 inches more than the normal. By divisions the averages were as follows: Northern, 7.24 inches, or 2.76 inches more than the normal; Central, 7.26 inches, or 2.67 inches more than the normal; Southern, 6.11 inches, or 1.47 inches more than the normal. The greatest amount, 11.98 inches, occurred at Gilman, and the least, 2.72 inches, at Glenwood. The greatest amount in 24 consecutive hours, 4.81 inches, occurred at Gilman, on the 24th.

Snowfall. The average snowfall for the State was a trace, or 0.1 inch less than the normal.

Wind. The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 60 miles an hour from the west, at Sioux City, on the 9th.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 66 or about 4 per cent more than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 51; Davenport, 72; Des Moines, 76; Dubuque, 67; Keokuk, 70; Sioux City, 62; Omaha, Nebr., 67.

Miscellaneous Phenomena. Aurora, 16th. Fog, 13th, 14th, 18th, 29th, 30th. Frost, 1st, 11th, 13th, 14th, 20th, 23d. Hail, Northern Division, 6th, 8th, 9th, 17th, 19th, 21st; Central Division, 8th, 9th, 17th, 18th, 19th, 20th, 21st, 22d, 25th, 26th; Southern Division, 8th, 9th, 19th, 21st, 22d, 23d, 24th, 26th, 27th, 28th. See note below. Halo (lunar or solar) 7th, 10th, 11th, 20th, 25th. Sleet, 13th. Thunderstorm, 6th, 7th, 8th, 9th, 10th, 13th, 14th, 15th, 17th, 18th, 19th, 20th, 21st, 22d, 23d, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st. Tornadoes, 8th, 9th, 19th, 21st, 31st.

Rivers. The rivers were below normal stages till about the middle of the month when the increased rainfall caused about the normal rise approaching the usual early summer maximum. Excepting slight overflows in some of the interior rivers of the eastern part of the State near the close of the month, the stages were generally moderate.

HAILSTORMS OF MAY, 1918.

M. V. Robins.

On the 6th light hail fell in Franklin County, and on the 8th and 9th a number of storms occurred, but on neither date was any serious damage reported, although in Jefferson County and southeast of Sanborn, O'Brien County, large hail fell. Hampton reported hail varying in size from one-fourth inch to one and one-fourth inches in diameter, but little harm resulted except that windows were broken and the soil packed by the stones. Grinnell reported a fall of moderate sized stones that injured tender plants and did considerable damage to greenhouses, and Mt. Pleasant a storm with but little damage. On the 9th hail fell in scattered

areas along the eastern border of the state, Dubuque reporting light hail with but slight damage. In the vicinity of Davenport there was a light fall covering an area about 8 miles in width by 10 in length extending from Rock Island and Moline, Ill., northward and northeastward to Eldridge and Argo, Iowa, and while some of the stones were very large, practically no damage resulted except to fruit blossoms. Burlington, Kingston and Danville reported hail and there was a heavy fall in Lee County, but no damage was reported. Pocahontas, in the northern section, also reported a light fall but no damage except to early garden truck. On the early morning of the 10th near Fairfield some damage resulted from hail that varied in size from hickory nuts to hen's eggs. On the 21st in the southwestern and south-central districts, considerable damage was done in Adams, Taylor, Pottawattamie, Fremont and Ringgold counties. In some places in the last named, hail the size of wrens' eggs drifted to a depth of several feet beating down oats, corn and garden truck. In the other counties in this district rye and other grains were seriously damaged and in places ruined, but fruit seems to have suffered most. In the southwestern part of Pottawattamie County over a considerable area, berries, garden truck and fruit were practically ruined.

COMPARATIVE DATA FOR THE STATE—MAY.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	57.7	—2.8	90	26	3.56	—1.01	6.44	1.61	-----	9	10	13	8
1891-----	58.3	—2.2	94	21	3.18	—1.39	7.10	1.46	-----	8	14	9	8
1892-----	54.0	—6.5	88	29	8.77	+4.20	12.64	4.87	T.	16	5	9	17
1893-----	56.6	—3.9	96	26	3.45	—1.12	5.82	1.65	0	9	13	9	9
1894-----	61.1	+0.6	96	22	1.87	—2.70	4.77	0.33	0	6	17	10	4
1895-----	61.7	+1.2	104	24	3.19	—1.38	5.79	0.84	0	9	11	12	8
1896-----	65.5	+5.0	100	34	6.69	+2.12	11.79	3.40	0	12	11	12	8
1897-----	58.5	—2.0	96	20	1.92	—2.65	3.59	0.21	0	5	16	10	5
1898-----	59.6	—0.9	92	26	4.67	+0.10	7.82	2.22	0	12	9	10	12
1899-----	60.2	—0.3	90	27	6.23	+1.66	11.47	3.09	0	13	9	12	10
1900-----	63.2	+2.7	98	22	3.31	—1.26	6.98	0.96	0	8	14	10	7
1901-----	60.7	+0.2	95	28	2.35	—2.22	4.57	0.72	0	7	16	9	6
1902-----	63.8	+3.3	97	25	5.39	+0.82	18.04	0.87	0	13	10	12	9
1903-----	61.6	+1.1	91	24	8.55	+3.98	15.45	2.88	0	16	9	12	10
1904-----	59.6	—0.9	93	27	3.78	—0.79	8.15	1.50	0	8	13	10	8
1905-----	58.3	—2.2	88	28	5.95	+1.38	10.83	2.57	0	14	12	11	8
1906-----	60.8	+0.3	95	24	3.54	—1.03	10.72	0.89	0	11	13	10	8
1907-----	53.5	—7.0	96	14	3.48	—1.09	7.68	0.71	1.0	10	11	10	10
1908-----	59.4	—1.1	93	13	8.34	+3.77	14.33	1.33	0	15	9	11	11
1909-----	57.9	—2.6	97	18	4.34	—0.23	7.85	1.86	0.1	9	12	12	7
1910-----	55.4	—5.1	89	18	3.41	—1.16	6.91	1.29	T.	10	15	7	9
1911-----	64.9	+4.4	98	23	3.76	—0.81	8.73	0.42	0.7	9	16	9	6
1912-----	62.7	+2.2	97	29	3.33	—1.24	6.41	0.72	0	10	14	11	6
1913-----	59.4	—1.1	102	30	6.24	+1.67	10.25	3.14	0	13	11	8	12
1914-----	62.2	+1.7	98	25	3.31	—1.26	6.90	0.30	T.	10	14	11	6
1915-----	56.1	—4.4	99	25	7.34	+2.77	13.21	3.82	T.	14	9	9	13
1916-----	59.9	—0.6	94	27	4.93	+0.36	10.44	2.14	T.	12	13	10	8
1917-----	55.1	—5.4	95	18	3.87	—0.70	7.33	1.69	0.6	10	15	8	8
1918-----	64.9	+4.4	98	9	6.87	+2.30	11.98	2.72	T.	13	13	11	7

T. indicates an amount too small to measure, or less than .005 inch rainfall, and less than .05 inch snowfall.

TORNADO OF MAY 9, 1918, PEARL ROCK TO CALMAR, IOWA.

By Hal P. Hardin, Observer,.

[Dated: Weather Bureau, Charles City, Iowa, May 25, 1918.]

(75th meridian meantime used herein.)

A tornado passed east of this county, Floyd, during the afternoon of May 9, 1918. The storm had some features which have made it difficult to determine whether there was more than one tornado, or only one storm that zigzagged over a strip 2 miles wide and 54 miles long. A straight line through the middle of the zone showing wreckage runs due SW.-NE. and encounters as many buildings and groves untouched as it does objects destroyed, while the character of the wreckage at points a mile or less from such a median line leaves no doubt that a tornado had visited them.

The writer visited Pearl Rock during the afternoon of the following day, i. e., May 10. There the width of the storm's path of destruction was about 200 yards, and could be defined as such for a distance of 2 miles from southwest to northeast. There was no indication of a whirling wind outside that belt, nor for some distance at either end of it. A number of persons who went through the storm at Pearl Rock and other points have told me that they saw the funnel-shaped cloud, heard a roaring noise as that of a rapidly moving railway train, and witnessed an inward-and-upward movement of objects toward it.

Pleasant Valley. A man who observed the first known formation of the funnel cloud at Lower Pleasant Valley, the point where the storm apparently originated, described to me what he saw, as follows: The weather had been warm, with thundershowers during much of the day. Shortly before 4 p. m. two thunderstorm clouds moved rapidly from the west and the east toward each other; there was vivid lightning with loud thunder, and the heat became oppressive. There had been strong winds during the day, but with the gathering of these clouds the wind ceased until there was no surface air movement. Overhead the clouds seemed to be boiling; in each bank light and dark clouds seemed to be trying to climb over one another. The two banks met over a point about 1 mile northeast of where the observer stood. There was less lightning and thunder than before; the western cloud bank absorbed that bank which had come from the east, all light shades disappeared, and the whole mass turned blue-black in color. There was a roaring noise, and from the point where he judged the lower edges of the clouds had met a downward bulge appeared and quickly developed into the funnel. A twisting, gyral motion was seen in the funnel, and he thought that he had noticed a revolving movement in the whole bulging portion of the cloud, but was not sure of it as he had not thought to look for it at the time. As the cloud started northeastward heavy rain and light hail fell where the observer stood, followed by light rain, high wind and cooler. This man was on an elevated piece of land, and says he could plainly see the funnel for 4 miles, and that it moved

straight northeastward toward Pearl Rock. All the damage in that 4-mile stretch is within a belt half a mile wide. There then follows a long reach without a visible trace of the storm; but there, as elsewhere in the storm's track, the greater part of the country is in pasture land and fields on which there are now no crops. There are no trees except along the banks of streams and around farm buildings.

Pearl Rock. Pearl Rock is a cluster of 8 or 10 farm houses at the crossroads forming the boundary lines between four counties—Butler, Floyd, Chickasaw, and Bremer; it is some 8 miles from the neighborhood known as Lower Pleasant Valley and lies northeast of the latter. The storm struck there (Pearl Rock) at 4:20 p. m., killing one woman and causing a property loss in and near the village estimated at \$50,000.

Nashua. After leaving Pearl Rock there is a reach where the path of the storm is lost before it struck (4:30 p. m.) the eastern side of the town of Nashua, Chickasaw County, 3 miles northeast of Pearl Rock. I was given practically the same description of the formation of a tornado cloud before the Nashua damage began, as that given by the man at Lower Pleasant Valley. The people who witnessed the gathering of the clouds did not then know that a tornado had visited Pearl Rock and thought that one was originating over them. They had the same weather and subsequent changes as at Lower Pleasant Valley: Saw two thunder clouds meet; heard the same roaring and saw the funnel descend. Along the river bank, and at the apparent end of the storm track from Pearl Rock toward Nashua there is a heavy timber growth. The upper limbs of the trees are stripped of branches, foliage, and so much of their bark that their nakedness is noticeable as far away as the trees can be seen. None of the trees are uprooted or show damage near the ground. If the storm at Nashua was the same one that formed at Lower Pleasant Valley and later struck Pearl Rock, the funnel was receding into the cloud when it passed over those trees, and had lost its identity when the cloud approached Nashua.

In eastern Nashua and near by, one man was killed and about \$100,000 worth of property, mainly farm buildings and stock, was destroyed. The time is generally placed at 4:30 p. m.

New Hampton. From Nashua the storm's track lies northeastward to New Hampton, in Chickasaw County and 18 miles from Nashua. The time it struck New Hampton is placed at 5 p. m. Between the two towns the destruction of property was great in localities, with no trace of the storm at other points within the reputed 2-mile width of its path. One woman was killed 6 miles southwest of New Hampton, one man on a farm a mile north of where the woman was killed, and a boy 1 mile south of the town. The property loss in and near New Hampton is estimated at \$160,000, mostly in farm buildings and stock; the loss in the town was only a few thousand.

Calmar. From New Hampton the storm track lies northeastward to Calmar, in Winneshiek County, 25 miles from New Hampton and 54 miles from Lower Pleasant Valley. The postmaster at Calmar places the time of the storm's arrival at 5:30 p. m. Two people were killed in the town and one on a farm 1½ miles east of town. The property loss is estimated at between \$200,000 and \$250,000, mainly in farm buildings and stock. The

path of the storm is reported as 1 mile wide and 15 miles long at Calmar. Between Calmar and New Hampton there are the same breaks in the continuity of the track and lack of evidence to sustain its reputed width, as exist between New Hampton and Nashua, and Nashua and Pearl Rock. At points between Nashua and Calmar there are communities within short distances from the reputed storm track where only black, threatening clouds were seen.

General character of weather along path.

Over the entire length of the track wherever there is trace of the storm in fallen trees, poles, and wrecked buildings the fall of objects was toward the north on the southeast side of the track and toward the south on the northwest side, except that some groves and buildings appear to have been uprooted or torn to pieces and then dropped in a confused heap. Probably the latter distributions occurred in the center of the vortex; owing to the predominance of open fields, one can not locate the exact center of the track.

All along the line reports agree that fresh winds and thundershowers occurred previous to the storm; that its approach was heralded by sharp lightning, loud thunder, tumbling light and dark clouds which changed to blue-black with pendent funnel; that a roaring noise was heard; that still air and excessive heat immediately preceded the blow which whirled around the funnel; that rain and hail accompanied the blow and light rain and falling temperature followed it. No damaging hail is reported.

If the same storm was concerned throughout, it progressed northeastward 54 miles in 1 hour and 30 minutes, a little better than ordinary automobile time. Its actual path was between 200 and 400 yards in width, but it seems to have ranged over a course 2 miles wide, in much the same way as a sailing vessel tacks over a wide course when beating to windward.

Injuries to population along route.

There were 8 lives lost, about 20 people injured, and about \$500,000 worth of property destroyed. All but two of the people killed were on farms, and all but a small portion of the property loss was in farm buildings and stock.

The dead lost their lives in the following ways:

Mrs. A. C. Carpenter, Pearl Rock: Struck by flying board while in the yard, unreasoningly refusing to enter the cellar under the house as her companion wished her to do. Results proved that she would have been safe in the cellar.

Mr. Roy Husband, near Nashua: Struck on head by falling cement block while in the cellar under building which was wrecked. The cellar was filled with wreckage; there were five others in it and all were more or less injured, but none have since died.

Mrs. Alice Dowd, six miles southwest of New Hampton: Manner of death unknown. Eighty-four years old and alone in building. Body found within foundation of barn, which had been blown away, badly broken and bruised. That she was killed while within the home nearby was established through a piece of the frame of her dead son's picture which she still retained in hand. The picture had hung in the living room, and when she felt the house going she probably tried to save it.

Mr. Albert Smith, five miles southwest of New Hampton: Struck on the head by a block from the chimney when the house was demolished. Wife and child with him escaped with bruises.

Theo. Krueger, Jr., one mile south of New Hampton: Killed by falling barn in which he had just placed horses. He and his father were bringing school children home in a wagon. When they saw the storm approaching they drove into a farmyard and sent the children into the cellar under the house. They then drove the team into the barn. The father remained outside; when the storm struck him he clung to an apple tree and escaped with bruises.

Mr. and Mrs. Peter Anderson, Calmar: Killed when their house fell to pieces and the wreckage of other buildings was piled on its ruins.

That more lives were not lost is partly because the storm did not cross the crowded parts of the few towns that it touched; and partly because its slow forward movement gave people time to seek cellars and other relatively safe places after they saw it approaching. Some such reported instances in illustration, follow:

Miss Vera Deisler, teacher at the Pearl Rock school, formed her pupils in a chain of clasped hands and led them to a hedge to which they all clung with the strength of desperation until the storm passed. The school building was scattered far and wide.

At one schoolhouse, totally wrecked, it is claimed that the change in time, daylight saving, probably saved many little children from death or injury. School had been dismissed for the day long enough for the children to have reached their homes. Under normal time they would have been in the building.

At another schoolhouse they were having a picnic in celebration of the end of the term. It was filled with women and children. When the storm was seen approaching they fled to a nearby farmhouse cellar. The house over the cellar was completely blown away, but not one of the thirty occupants of the cellar was injured.

East of Nashua there is a group of Piersons, father and sons, on adjoining farms. All took to cellars, and while some of the houses went away no one was hurt. Mr. E. D. Pierson, his wife and five children went into the cellar. Before they realized that their house had been hit they were looking up into the very heart of the tornado, which was trying to lift them out of their refuge. By clinging to each other and to the wall of the cellar they managed to stay on the floor till the storm passed.

Some children alone at their home remained in the yard until they saw a neighboring place going, then took to their cellar. The house and outbuildings were wrecked, but when the parents returned they found the children safe.

But the cellar under a building is not always a safe refuge. In the above accounts, it is related that one man was killed and others injured by falling débris while in such a cellar. Some of the reported instances where the cellar was unsafe were:

Mr. Cecil Gray, near New Hampton, would not risk the cellar because it was shallow. He, his wife and child clung to some lilac bushes and escaped. The house tumbled into the cellar and the wreckage caught fire.

Mrs. McGrath, near Nashua, led her children into a plowed field where all lay in furrows with safety. Had they gone into their cellar they would probably have been killed, as the house collapsed and fell into the cellar.

Mr. Strawson, near Nashua, had a new modernly constructed home, one of the best farm buildings in this section of rich farms. Before going into the basement he took the precaution to throw water on the furnace fire to guard against that possible danger, thinking the basement otherwise safe. When the storm began tearing the house to pieces he and his family huddled

together in the northwest corner. Suddenly a section of the roof dropped over them, one edge resting on the foundation wall, and at the same time the rest of the basement was filled with wreckage and their section of roof was piled high with it. But for the lucky falling of that piece of roof all would have been killed.

Evidently the safe cellar is one located far enough away from buildings to be reasonably safe from falling wreckage and having a sod roof.

Some reported tornado freaks:

Mr. Smith, fishing from a boat on the Cedar River near Nashua, was thrown from the boat. He clung to some bushes and was whipped about by the wind until his arms were nearly torn from his shoulders, but saved his life. The boat was broken up.

A family caught in a plowed field lay the storm out in furrows. There was a dog with them. As the cloud approached, the dog was seen to be desperately trying to dig himself into the ground. When the cloud was over them the suction was so great that the people had all they could do to stay in the furrows and did not see what happened to the dog. After the storm he was gone. The next day he limped into the farmyard, footsore and exhausted; much of his hair was gone and the remnant twisted or on end. Those people think that the dog was sucked up into the cloud and dropped a long way from home.

That this explanation of the dog's appearance and long absence is not improbable is evidenced by the mud deposited on buildings and other objects struck by the storm. This mud had been picked up from wet plowed land and carried along, possibly many miles. Also, along the path of the storm dead chickens were found, their bodies crushed flat and entrails protruding. It is claimed that a strong man could not throw a full-grown hen against the ground hard enough to produce that result. Apparently the storm picked them up and then threw them down with great force.

A large silo at Pearl Rock had its staves pushed in, but not broken. The roof was merely pushed partly off. The silo had a small quantity of ensilage in it. The staves were raised off the bottom boards some 10 to 18 inches. There are the usual number of rod-iron hoops on the silo. None of these broke.

The Cedar Valley Electric Co. has a power circuit of large copper wire on poles along the road through Nashua and Pearl Rock. In places the poles were torn out of the ground, the wire pulled from the poles and twisted into every possible shape, whole spans of it being compressed into two or three-foot lengths. The company estimated their loss in material to be \$6,000. None of the recovered wire can be used again and much of it has not yet been located.

TORNADO OF MAY 9, 1918, AT ELDRIDGE, IOWA.

By Julius M. Sherrier, Meteorologist.

(Dated: Weather Bureau, Davenport, Iowa, May 13, 1918)

At 6:00 p. m. May 9, 1918, normal central time, when a cyclone of marked intensity was central near Dubuque, a highly destructive tornado appeared about $3\frac{1}{2}$ miles southwest of Eldridge, Scott County, Iowa, and moved northeastward through the northern portion of the town, disappearing at a point about four miles to the northeastward of that place.

Frequent thundershowers had occurred at Davenport during the day, with hail from 5:10 p. m. to 5:25 p. m., but nothing unusual in the cumulonimbus cloud formations was at any time observed at the Weather Bureau office, nine miles to the southward of the tornado's track. The appear-

ance of the pendant cloud at Eldridge has been variously described as resembling a funnel, a question mark and a column of nearly uniform diameter. Most observers agree that where it approached the ground the cloud was greatly enlarged and intensely black, resembling smoke arising from burning crude oil or asphaltum. With a progressive motion of about 50 or 60 miles per hour, the pendant cloud appeared to approach the town of Eldridge in a rather leisurely manner and was deliberately viewed by a considerable number of persons, some of whom were miles away on either side of the track. As it reached a group of buildings, the structures were suddenly hidden from view, as if by a dense smoke screen, and boards and other debris were to be seen a few moments later emerging from the lighter portions of the cloud column at great elevations above the ground. One careful observer stated that he and his grown daughter had estimated the funnel or column to be about half a mile in length. The noise of the oncoming tornado seemed to some like the roar of an enormous conflagration, and to others like an approaching express train moving at its highest speed, with an additional whistling sound like that of escaping steam.

Trees on the northern side of the storm track were found to be lying towards the southwest and south; those on the southern side towards the northeast, north and northwest, while in the middle of the path of greatest destruction there was no regular arrangement of trees and other wreckage.

The path of the tornado was about 600 feet wide and nearly eight miles long, the greatest damage occurring within a strip about 450 yards in width and about four miles in length, terminating at the northeast corner of the town of Eldridge. At a farm about three miles northeast of Eldridge the barn was unroofed and some other outbuildings were wrecked, after which the pendant cloud gradually lifted and disappeared.

Dwellings and all outbuildings on four farms to the southwest of Eldridge were totally destroyed. On two other farms the outbuildings were wrecked and the farm buildings badly damaged. Five houses and a small church within the town were blown down, while a number of other houses were damaged to a considerable extent. The money value of the buildings, household effects and farm implements destroyed in the country has been reliably estimated at \$36,200, and the amount of loss in the town has been placed at \$25,100. Considering the severity of the storm, the loss of live stock was remarkably light and will hardly exceed \$2,000. About a dozen head of cattle, a team of horses, some hogs, and a considerable number of suckling pigs were killed or badly injured. The total amount of damage has been placed, therefore, at \$63,300. No corn was up and the damage to other crops were almost negligible, with the possible exception of fruit trees which were in blossom at the time, but for which no estimate of loss can be given.

Eleven persons were injured more or less seriously, and eleven others sustained such slight injuries as cuts, sprains, bruises, nervous shock, etc. Mrs. John Priester, one of those injured died on May 14th, but all others are expected to recover.

Freakish performances were not missing in the case of the Eldridge storm. A fully grown horse, said to weigh about 1500 pounds, was picked up by the wind and carried a distance that has been reported as 250 feet,

without the animal's having been injured in the least. At the farm of Mr. W. H. Wilford, a barn that had sheltered a herd of cattle was blown away, leaving the terrified but unharmed animals standing on the floor or platform of the building. The cows were milked shortly after the storm had passed. Within the town, a garage was carried away and scattered over the surrounding country, while the automobile it had contained was left without a scratch upon its paint and with its windshield unbroken. A frail lattice for vines or flowers was left standing in the center of the path of greatest destruction. A pigeon is reported to have been blown against a tree with such force that its beak was driven firmly into the wood, the dead bird remaining suspended in that manner for several days.

Between five p. m. and six p. m., normal central time, hail occurred throughout an area about ten miles in length and about eight miles in width, extending from the cities of Rock Island and Moline, Ill., northward and northeastward to Eldridge and Argo, Iowa. Notwithstanding the large size of the hail stones, some of which were fully 0.8 inch in diameter, there was no serious loss reported from this cause.

TORNADOES OF MAY 21, 1918.

By Charles D. Reed, Meteorologist.

(75th meridian mean time used herein.)

Remarkable tornado activity was manifested in five distinct and widely separate paths on May 21. The locations of these paths are shown on the chart on page 37. As usual, the damage was intermittent and more or less zigzag along these paths but reports from practically every township and in many cases every section crossed, show by the time of occurrence and the description, the unmistakable progressive motion and continuous identity of each tornado, and each one at all stages showed the characteristic funnel shape cloud, rotary winds and position of debris:

1. Tornado, Denison to Stanhope.

The earliest tornado started about 2:15 p. m. a few miles southwest of Denison, Crawford county (see storm track No. V on chart, page 37.) moving in a general east-northeasterly direction, passing north of Denison and south of West Side in Crawford county, south of Arcadia, north of Carroll and south of Lanesboro, Carroll county, between Adaza and Churdan in Greene county, entering the southwest corner of Webster county and moving almost due eastward through the south tier of townships south of Harcourt and moving into Hamilton county just north of Stanhope and disappearing north of Stratford about 4:30 p. m. The total length of the path of the storm was about 69 miles and its total duration 2 hours and 15 minutes. Its average rate of progress was about 31 miles per hour. The average width of the path of greatest destruction was 2475 feet or 165 feet less than a half mile. It was widest, $2\frac{1}{2}$ miles, near Harcourt. Over the first half the path averaged about 800 feet wide and over the last half 4450 feet. There were places near the beginning and toward the end where there were occasional skips in the path of destruction, but over most of its course the destruction was complete.

In the vicinity of Denison there was one death, Emmet Eling, four injuries and property damage totaling \$75,000. At West Side one person was injured and property damage about \$12,000. In the vicinity of Arcadia and Carroll in Carroll county there were two deaths, Joseph Brinks and baby son, 8 persons severely injured and property damage probably exceeding \$100,000. North of Glidden there were no deaths nor injuries but property damage was about \$20,000.

In the northwest part of Greene county there were two deaths, Everett Roberts and J. G. Zeanor, 20 were injured and the property loss was about \$75,000.

In Webster county there was one death, C. J. Anderson, 2 seriously injured and property damage \$100,000. In the southwest part of Hamilton county there were no deaths or injuries and the property damage was about \$10,000.

2. Tornado, Berkley to Wellsburg.

Great destruction attended another tornado on this eventful day, due to the fact that it passed through the southeast portion of the town of Boone where among other things it demolished the shops of the Chicago and Northwestern Railway. This storm originated a few miles northeast of Berkley in Marcy township, Boone county, about 3:45 p. m. It pursued a somewhat sinuous course in a general northeasterly direction. (See storm track No. VI, on chart, page 37.) In passing through Marcy and Worth township, 12 persons were injured and \$21,230 worth of property lost. The storm then turned northward toward Boone, then eastward as it struck the southeast portion of the town, then northeastward again. Inside the city limits of Boone 9 people were killed and 55 injured. Those killed were:

James Bills
Charles Kilborn
Mrs. Frank (Frenchie) Roberts
Earnest Lindquist
Albert Daniels
Mrs. Albert Daniels.
Mikie Knezivik
Severed Larson
Nic Karasiles.

The property damage was conservatively placed at \$500,000.

Mr. A. E. Reid of Boone, kindly furnished the following notes of his observation of the storm:

I stood at Ninth and Story streets looking directly south on Story and first noticed a large wind cloud very low and moving rapidly east; higher up and to the north of this cloud were other apparent wind clouds moving rapidly west, and between these other clouds were describing a comparatively slow circular movement. This was the only sign I actually observed of any whirl. Being informed by a train dispatcher that a tornado was bound our way from towards Moingona. I realized for the first time what I was looking at. I then went to my office on the second floor of the Northwestern freight house and we watched the storm from the south windows as it moved northeastward. By this time the clouds were very dense and rushing apparently right on the ground and there was a continuous roar

like multiplied Niagaras until the Northwestern shops were struck, when the roar was combined with a tremendous rending and crashing and in appearance was like a fountain of debris in the air. As soon as the storm passed the shops I went to the street where a downfall of oak leaves was in progress; these had evidently been carried from the woods to the south by the storm.

My wife, who was at home on South Story street, tells me that there was continuous brilliant lightning in the cloud and that shortly preceding and during the passage, there was an intense hot wave.

I am not positive as to the exact duration of the storm, but it seemed to me to be not over five minutes from the time I first saw the clouds to the south until they had passed through the shops to the east.

Mr. Reid had a self-recording barometer or barograph at his residence a little less than half a mile from the storm. This showed an abrupt fall of .20 inch in a 40-minute period just before 7 a. m., then a rise of .10 inch to 10 a. m., then a gradual fall of .05 inch till 2 p. m., then an increasingly rapid fall of .15 inch in the two hours just preceding the storm, after which it rose quite steadily .25 inch by midnight.

The storm passed on northeastward through Boone county, the northwest corner of Story county, the southeast corner of Hamilton county, diagonally across Hardin county and disappeared in the northwest part of Grundy county near Wellsburg about 5:15 p. m. The total path was about 67 miles in length. Its greatest breadth was $2\frac{1}{2}$ miles near Hubbard. However, eyewitnesses state that there was more than one tornado in this vicinity at the time and R. R. Swallum who was watching the storm says he saw at least five. Its average breadth was a slightly more than one-half mile. The total duration was 1 hour and 30 minutes and the average rate of progress was about 45 miles per hour.

In Des Moines township outside the city limits of Boone 2 persons were injured and the property loss was \$74,000. In Jackson township one person was injured and the property loss was \$2500. In the northwest part of Story county near Story City there was considerable damage but it has been impossible to obtain estimates.

In the southeast corner of Hamilton county, at Ellsworth, 2 persons were injured and the property loss was \$6,000. In the vicinity of Radcliffe, Hardin county, 6 persons were injured and the property loss was \$5,000. Near Hubbard the damage was \$85,250 but there were no injuries nor deaths. In the vicinity of Eldora the property loss was \$150,000, one person seriously injured and 9 slightly, but no deaths. Near Steamboat Rock H. J. Finster was killed, one person was injured and the property loss was about \$8,000. In the northwest part of Grundy county, near Wellsburg, there were no deaths or injuries but the property loss was about \$15,000. The total deaths in this storm were 10; injured, 91; damage, \$897,980.

3. Tornado, Prairie City to Tama.

Starting from a few miles south of Prairie City, Jasper county about 3 p. m., a tornado dipped down at intervals along a northeasterly course diagonally across this county and headed for Tama, Tama county, but turned abruptly eastward, passed south of the town and soon disappeared. (See storm track No. VII, page 37. The chief damage was done in the town of Newton, where it amounted to \$200,000. One George Reid, lost

his life and one person was injured. Immediately after passing Newton the storm lifted but dipped down again in Kellogg, where the damage was \$2,000, and in Hickory Grove, the northeast township in Jasper county, where the damage amounted to \$100,000, but no one was killed or injured. In Tama county the damage was of a minor nature, being confined to roofs, chimneys and sheds. Part of the damage resulted from hail stones which varied from one inch to the enormous size of 6½ inches in diameter. No satisfactory estimate of the damage can be made. In this storm there was one death, one serious injury and \$350,000 property damage. The storm traveled slowly, a total of only 41 miles in 2 hours.

4. Tornadoes in Clayton County.

About 6 p. m. a tornado originated near Wood and moved northeastward near Elkport, crossing the Mississippi at Guttenberg and continuing to the vicinity of Baraboo, Wis., a total distance of about 100 miles in 2 hours, or an average of 50 miles per hour. The damage in Iowa was about \$30,000. Eight persons were injured; none killed. Rumors have been received that the early stages of this storm appeared in the northwest part of Linn county near Walker, but confirmation is lacking. About 7 to 7:30 p. m. another tornado moved in a path parallel with the first, passing about 2 miles northwest of Elkport and about a mile into the south central part of Garnavillo township. The path was about 10 miles long and the total damage was about \$3,000. (See storm tracks Nos. VIII and IX, page 37.)

Mr. J. H. Spencer, Official in Charge Weather Bureau Office, Dubuque, Iowa, obtained the following interesting description of the storm from Mr. W. H. Landschultz of Dubuque:

I happened to be at Elkport during the late afternoon and night of May 21st. At 5 p. m. the atmosphere was hot and close. It was so bad, in fact, that I thought something was going to happen, and remarked to a fellow traveler, "This feels like tornado weather." At about 6 p. m. the alarm was given that a tornado was approaching. I rushed out of the hotel, and off to the southwest a roaring, whirling funnel cloud was plainly visible, moving northeast. It was a terrible and awe-inspiring sight. The funnel cloud was of inky blackness and extended downward to the ground, but would occasionally rise. As it passed by it was about one and one-half miles away at the nearest point. The air where we stood was entirely calm, but the clouds between us and the funnel cloud were rushing pell-mell toward the funnel.

Little or no rain fell in advance of the tornado, and remarkable to state, I saw the funnel cloud for 15 to 20 minutes before it was finally obscured by the heavy rain that followed it. We saw an object within the funnel cloud that looked like the roof of a house or barn. It remained in the air but was carried up and down.

The weather did not cool off after the tornado to the southward passed by. It remained hot and close and at about 7:30 p. m. another tornado passed about two miles north of Elkport. We did not see its funnel cloud.

On the 22d I crossed the path of the first tornado and witnessed the destruction it had wrought. Trees two to three feet in diameter were torn up by the roots and carried a long distance. The trunks of other trees were still standing, but completely stripped of branches and bark. Farm buildings were destroyed. Woven wire fences were moved bodily for many yards. A steel binder was picked up from a field and dashed to pieces in

the road along which we passed. Some farm animals were killed. A few people were injured but no one killed in this immediate vicinity. As I passed along the road I could see the path of the storm for miles each way, so great had been the destruction. The path was about half a mile wide at the widest points, but not nearly so wide at the points of greatest destruction.

The newspaper accounts of the tornadoes of May 21st were in no wise exaggerated. After having witnessed one at close quarters I am convinced that no meteorological phenomenon is so terrifying and of such destructive force. Fortunately they are not of common occurrence.

The Postmaster at Guttenberg, Iowa, reports the arrival of the storm there at 6:30 p. m.

A funnel cloud seemed to travel slowly from southeast to northwest and was attended by a heavy rumbling noise. Color was dark slate. Lightning all around. Only a little rain occurred before the storm struck—heavy after. Hail did not amount to much. Storm was a whirl and it threw wreckage 150 feet up along the hillside. Path in Guttenberg was about two city blocks wide and about eight city blocks long, then it crossed the Mississippi into Wisconsin. No one was killed but three were injured. Houses were unroofed, barns and other buildings were wrecked and some were blown across the river into Wisconsin. Estimated property loss about \$20,000.

Later: Reports from Walker, in the northwest part of Linn county, show that about 6:45 p. m. May 21, a tornado moved east-northeast through that town, causing the death of Mrs. Wm. Ossman, the serious injury of two others, and property damage amounting to \$52,000. Some reporters place the damage considerably higher.

Weather Conditions Favorable for Tornadoes.

Attention is invited to a copy of the daily weather map of the United States Weather Bureau on page 34 showing the general weather conditions prevailing at 7 A. M. May 9, 1918. An area of low barometer or general storm center was located in central Nebraska, the lowest barometer reading being 29.18 inches at North Platte. The barometric gradient or slope was steep from the Mississippi River across Iowa to eastern Nebraska, amounting to .40 inch in 500 miles. As usual in such cases, warm, southern, moisture laden air was being transported northward over Iowa in tremendous volumes. Intervals of sunshine warmed the air rapidly at the surface. From around 60 degrees in the morning the temperature rose about 30 degrees by early afternoon, which set up strong by the proximity of the general storm center. Towering cumulo-nimbus convectional (up and down) currents, the up-currents being greatly aided clouds here and there over the State raised their heads and in some cases a large part of their bodies into the rapidly moving, wintry, westerly winds aloft that had not had time to be warmed by the springtime sunshine caught and radiated by the ground. Where these conditions were most pronounced tornado vortices formed. By 7 p. m. of the 9th the general storm center was crossing the Mississippi River at almost the identical time and place that the tornadoes occurred in Clayton county. By the next morning the general storm center had moved to a point in Canada northeast of Lake Huron and the danger of further tornadoes was over till a similar set of conditions could be pieced together in the meteorological kaleidoscope.

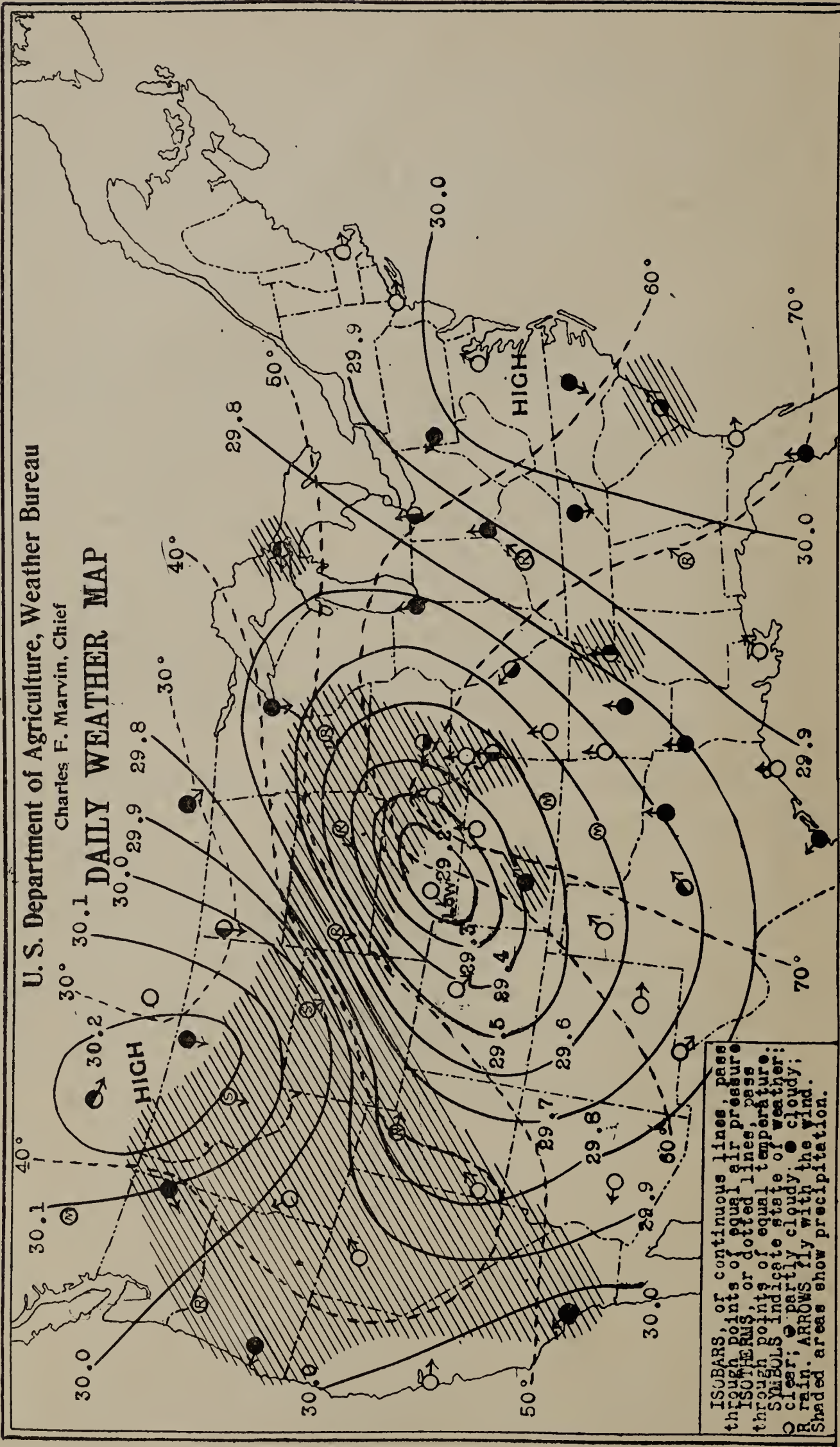
In this case there was not long to wait, for May 21 was one of the worst tornado days in the history of Iowa. The weather map of 7 a. m. that date on page 35 shows a general storm center with a barometer reading of 29.62 inch at Valentine, Neb. The barometric gradient or slope across Iowa from the Mississippi River to extreme eastern Nebraska was .50 inch in 400 miles, showing considerable more energy than the map of May 9. Much the same temperature, moisture, wind and cloud conditions prevailed, only that, if anything, the summits of the cumulo-nimbus clouds rose higher. The great cloud mountains in which the Boone and Newton tornadoes were generated were plainly visible at Des Moines. In this case the general storm center took a wide detour. At 7 p. m. it was near the northwest corner of Minnesota and by the next morning it was north of Lake Superior.

WEATHER CONDITIONS FAVORABLE FOR TORNADES.

7 A.M. MAY 9, 1918.

U. S. Department of Agriculture, Weather Bureau
Charles F. Marvin, Chief

DAILY WEATHER MAP

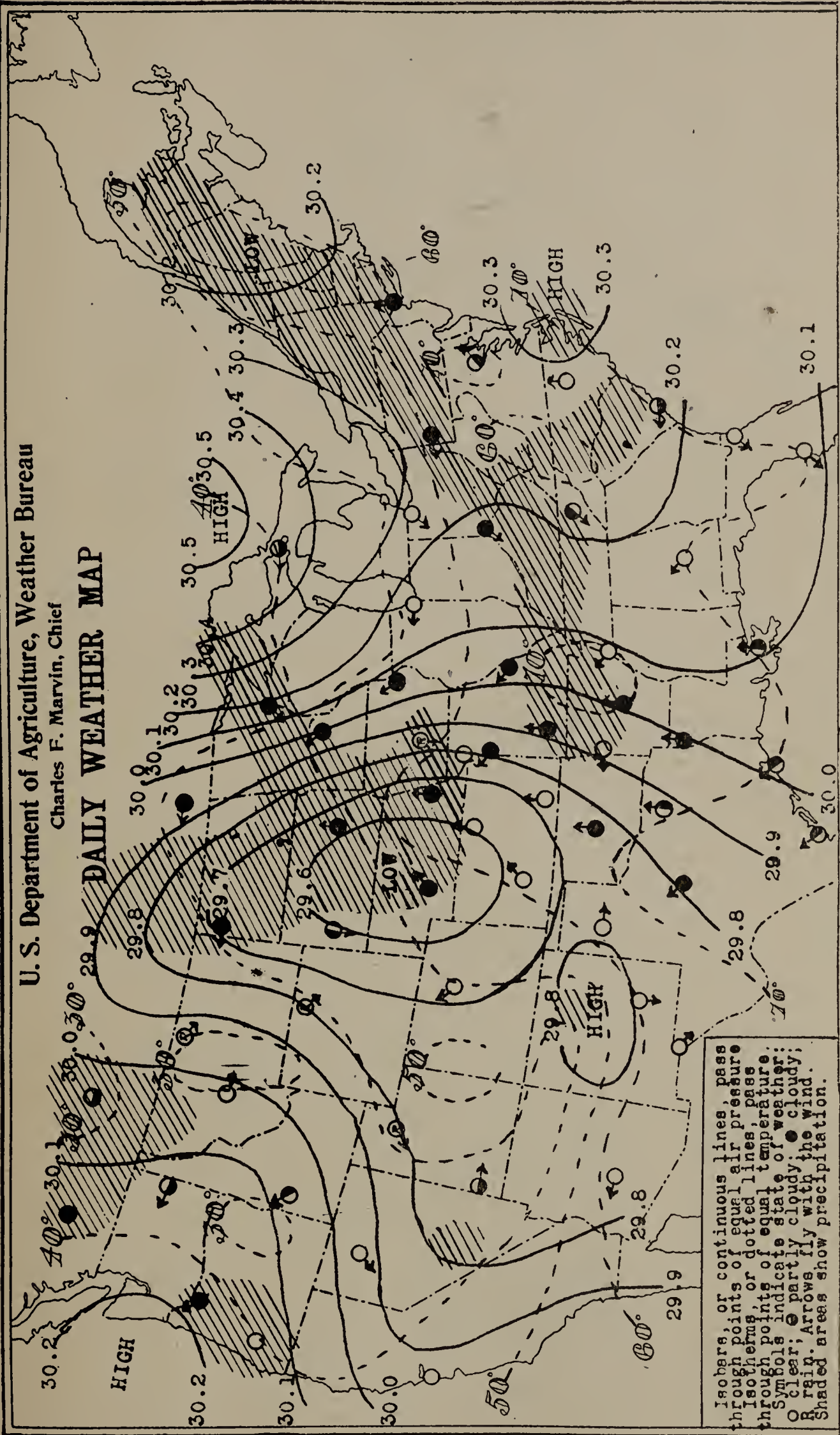


7 A.M. MAY 21, 1918.

U. S. Department of Agriculture, Weather Bureau

Charles F. Marvin, Chief

DAILY WEATHER MAP



Isobars, or continuous lines, pass through points of equal air pressure. Isotherms, or dotted lines, pass through points of equal temperature. Symbols indicate state of weather: \bigcirc clear; \odot partly cloudy; \bullet cloudy; R rain. Arrows show the wind. Shaded areas show precipitation.

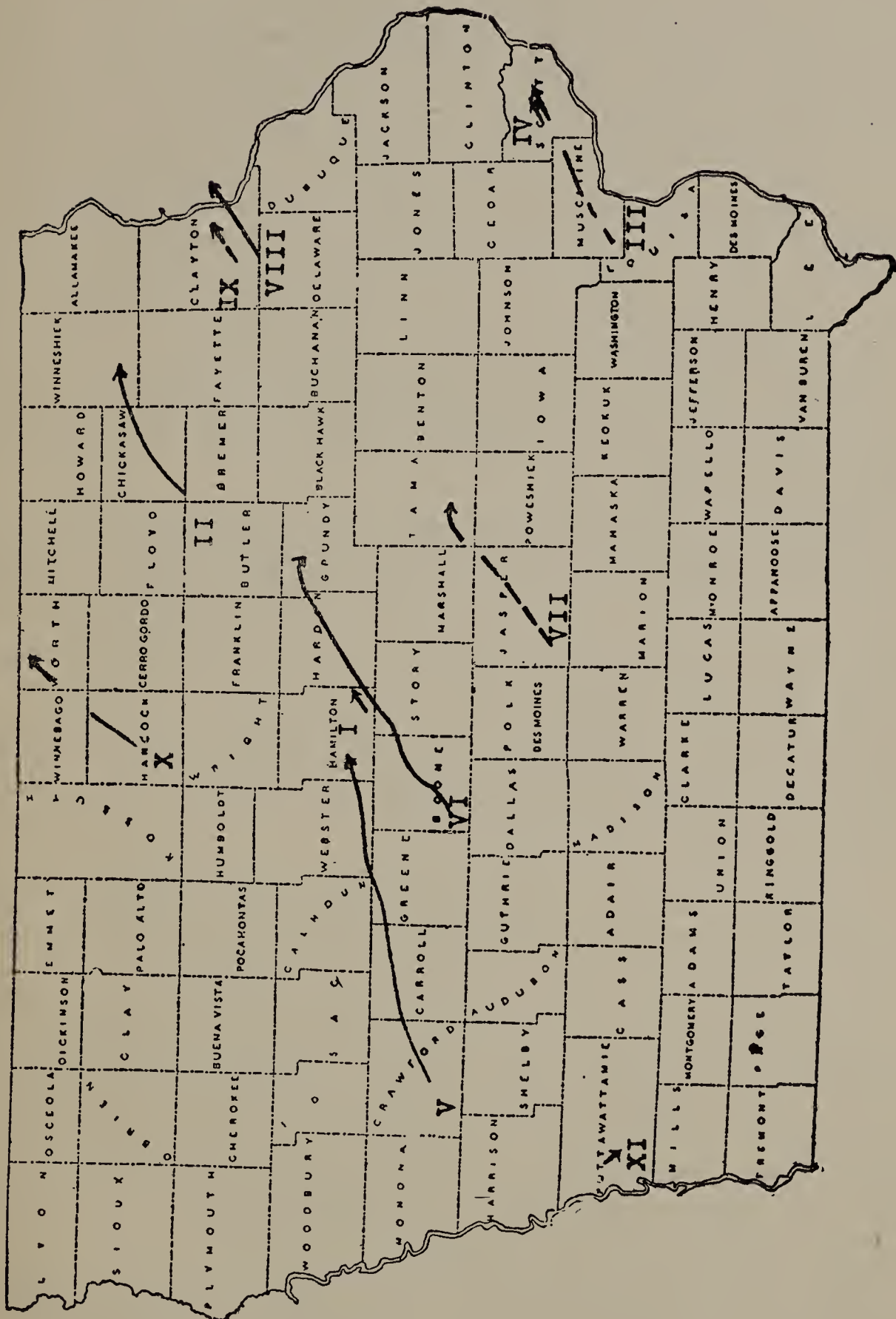
TORNADOES IN IOWA DURING THE YEAR, 1918.

Storm No.*	Nearest Towns	Date	Hours	Storm Moved From	Length of path, miles	Persons killed	Persons injured	Estimated damage
I	Randall to Ellsworth	May 8	3.30 p.	S. W. to N. E.	4	0	0	3,500
II	Pearl Roek to Calmar	May 9	4-5.30 p.	S. W. to N. E.	54	8	20	500,000
III	Conesville to Eldridge	May 9	6.10 p. to 7 p.	S. W. to N. E.	42	1	22	103,300
IV	Eldridge	May 19	6 p.	S. W. to N. E.	1½	2	2	2,000
V	Denison to Stanhope	May 21	2.15 p. to 4.30 p.	W.-S. W. to E.-N. E.	69	6	35	492,000
VI	Berkley to Wellsburg	May 21	3.45 p. to 3.15 p.	S. W. to N. E.	67	10	91	897,980
VII	Prairie City to Tama	May 21	3-5 p.	S. W. to N. E.	41	1	1	350,000
VIII	Wood, Iowa, to Baraboo, Wis.	May 21	6-8 p.	S. W. to N. E.	12	†	†	†
IX	Elkport to Garnavillo	May 21	7 p.	S. W. to N. E.	10	0	0	3,000
X	Walker	May 21	6.45 p.	W.-S. W. to E.-N. E.	3	1	2	52,000
XI	Britt to Silver Lake	May 31	2-4 p.	S. W. to N. E.	32	0	2	20,000
	Weston	July 14	9.30 p.	N. W. to S. E.	½	0	0	600
				Totals	335	29	182	\$2,454,380

*Roman numerals refer to storm track on accompanying chart. †In Iowa, only.

TORNADO PATHS IN IOWA DURING THE YEAR, 1918.

(Numerals Refer to Descriptive Data in Accompanying Table.)



JUNE

Temperatures averaged about 5 degrees in excess of the normal in the southwestern and about 1 degree below normal in the northeastern counties. The period 10th-16th was notably warm. On the 16th, many stations reported temperatures of 100 degrees or higher and broke their June records. During the period, 2d-5th, excessive rains occurred from Webster and Hamilton, southeast to Poweshiek and Johnson counties, causing unusual overflows in the watersheds involved. Precipitation was very deficient in several southwestern counties. A severe hailstorm occurred in portions of Polk, Marion and Mahaska counties on the 27th.

Crops made excellent progress, except oats which were prematurely ripened by the hot weather in the southwestern portion of the State; early potatoes also were injured. Corn was far advanced and some laid by at the close of the month. Rye harvest began in the southern counties about the 25th, and oats toward the close of the month.

Pressure. The mean pressure (reduced to sea level) for the State was 29.93 inches. The highest recorded was 30.33 inches, at Sioux City, on the 7th, and the lowest was 29.56 at Sioux City on the 1st. The monthly range was 0.77 inch.

Temperature. The mean temperature for the State, as shown by the records of stations, was 70.8°, or 1.7° higher than normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 68.7°, or 1.1° higher than the normal; Central 70.6°, or 1.3° higher than the normal; Southern, 73.1°, or 2.8° higher than the normal. The highest monthly mean was 76.4°, at Thurman, in the extreme southwestern part of the State, and the lowest was 65.7° at Postville, in the extreme northeast. The highest temperature reported was 105° at Omaha, Nebr., on the 16th and the lowest was 38°, at West Bend, on the 2d. The temperature range for the State was 67°.

Humidity. The average relative humidity for the State at 7 a. m. was 77 per cent, and at 7 p. m. it was 60 per cent. The mean for the month was 69 per cent, or normal. The highest monthly mean was 74 per cent, at Charles City, and the lowest was 66 per cent, at Sioux City.

Precipitation. The average precipitation for the State, as shown by the records of 111 stations, was 5.29 inches, or 0.91 inch more than the normal. By divisions the averages were as follows: Northern, 4.89 inches, or 0.46 of an inch more than the normal; Central, 6.49 inches or 2.17 inches more than the normal; Southern, 4.50 inches, or 0.11 of an inch more than the normal. The greatest amount, 10.19 inches, occurred at Monroe, and the least, 1.55 inches at Audubon. The greatest amount in 24 consecutive hours, 5.37 inches, occurred at Monroe, on the 24th.

Wind. The prevailing direction of the wind was from the southeast. The highest velocity reported from a regular Weather Bureau station was 45 miles an hour, from the northeast, at Sioux City, on the 24th.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 69, or about 1 per cent more than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 57; Davenport, 67; Des Moines, 76; Dubuque, 64; Keokuk, 67; Sioux City, 74; Omaha, Neb., 80.

Miscellaneous Phenomena. Aurora, 9th, 11th. Fog, dense, 4th, 6th, 25th, 26th, 28th. Hail, Northern Division, 3d, 6th, 14th, 20th, 27th, 30th; Central Division, 3d, 5th, 27th; Southern Division, 1st, 2d, 3d, 4th, 5th, 24th, 27th, 28th. The hailstorms of June will be more fully covered in our report for July. Halos (solar), 1st, 2d, 7th, 9th, 11th, 22d. Thunderstorms, all days except 7th, 8th, 11th, 12th, 15th, 21st, 22d, 23d. Rainbow, 5th, 29th.

Rivers. Moderate stages prevailed in the Missouri River but the flood stage was not reached, nor was the flood stage reached on the Mississippi except near Keokuk, where flood conditions prevailed from the 10th to the 14th, inclusive, due to the heavy discharge of the Skunk, Iowa and Des Moines Rivers; above Burlington moderate stages prevailed but a great deal of bottom land was flooded and some crops destroyed. In the interior of the State rivers and small streams were overflowed for a considerable period due to an unusually heavy fall of rain on the 3d and 4th, in the central counties. At Boone the Des Moines River reached a stage of 23.2 feet on the 5th, which is within 2.2 feet of the highest of record and 6.2 feet above the flood stage. The principal damage was to crops and bridges but there was some damage to other property, and train movements for a time were demoralized.

COMPARATIVE DATA FOR THE STATE—JUNE.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	72.7	+ 3.6	106	44	7.76	+3.38	16.53	1.57	-----	11	12	10	8
1891-----	69.1	0.0	99	37	5.39	+1.01	19.88	1.68	-----	11	8	10	12
1892-----	69.2	+ 0.1	102	42	5.19	+0.81	14.16	0.67	-----	10	12	11	7
1893-----	71.2	+ 2.1	100	40	3.91	−0.47	7.56	1.36	-----	8	15	11	4
1894-----	73.2	+ 4.1	104	34	2.67	−1.71	6.20	0.57	-----	7	16	10	4
1895-----	69.7	+ 0.6	102	34	4.32	−0.06	9.26	0.98	-----	10	11	11	8
1896-----	69.1	0.0	100	40	3.11	−1.27	7.89	0.81	-----	9	12	13	5
1897-----	69.1	0.0	103	29	3.81	−0.57	9.38	1.03	-----	10	10	12	8
1898-----	71.4	+ 2.3	99	42	4.72	+0.34	12.48	1.90	-----	9	13	10	7
1899-----	70.7	+ 1.6	100	42	5.04	+0.66	11.99	1.10	-----	10	12	13	5
1900-----	69.7	+ 0.6	102	38	3.98	−0.40	12.35	0.67	-----	5	17	10	3
1901-----	72.3	+ 3.2	106	30	3.71	−0.67	7.84	1.05	-----	9	15	11	4
1902-----	65.2	− 3.9	97	32	7.16	+2.78	16.04	1.46	-----	14	8	11	11
1903-----	64.6	− 4.5	96	30	2.86	−1.52	6.04	0.75	-----	10	13	10	7
1904-----	67.1	− 2.0	94	35	3.45	−0.93	8.35	0.44	-----	7	13	10	7
1905-----	69.9	+ 0.8	100	36	5.53	+1.15	14.89	1.80	-----	10	12	11	7
1906-----	67.9	− 1.2	99	37	3.92	−0.46	8.27	1.48	-----	8	15	10	5
1907-----	66.5	− 2.6	98	36	5.35	+0.97	9.33	2.07	-----	11	14	9	7
1908-----	67.1	− 2.0	94	35	5.66	+1.28	11.88	1.77	-----	13	12	10	8
1909-----	69.1	0.0	96	40	6.41	+2.03	13.30	2.80	-----	13	12	10	8
1910-----	69.5	+ 0.4	105	33	1.99	−2.39	5.51	0.05	-----	7	18	7	5
1911-----	75.7	+ 6.6	108	36	1.82	−2.56	6.28	0.06	-----	5	20	8	2
1912-----	66.2	− 2.9	101	34	2.74	−1.64	5.71	0.78	-----	7	15	9	6
1913-----	71.5	+ 2.4	102	33	3.31	−1.07	8.95	0.74	-----	7	19	8	3
1914-----	72.2	+ 3.1	101	40	5.57	+1.19	13.24	1.17	-----	13	12	14	4
1915-----	65.1	− 4.0	91	31	4.16	−0.22	9.99	1.72	-----	11	12	12	6
1916-----	64.5	− 4.6	96	38	3.71	−0.67	7.96	1.41	-----	10	13	11	6
1917-----	66.0	− 3.1	100	32	6.65	+2.27	13.82	3.04	-----	12	13	10	7
1918-----	70.8	+ 1.7	104	38	5.29	+0.91	10.19	1.55	-----	11	16	10	4

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

JULY.

Temperatures averaged slightly below normal in all but the southwest counties where there was a slight excess, the largest excess being 3.6 degrees at Corning. Comparatively cool weather prevailed on the 1st, 6th-13th and 29th-31st. The warmest period over most of the State was the 24th-28th, though many stations in the north reported their highest temperatures about the 20th. Three general rain periods, 4th-7th, 14th-15th and 22d-26th resulted in deficient totals, except in the north two tiers of counties and from Marshall southeast to Muscatine and Scott counties. In the central counties of the southern tier, the deficiency approached 4 inches. Excessive rains occurred in the north-eastern counties on the 25th-26th, which, together with high winds, beat down the corn and oats badly and delayed harvest. Otherwise harvest progressed rapidly, with unusually good conditions for labor and curing of the shocked grain. Threshing was well under way in the south half of the State the last of the month. Yields and quality of small grains were generally good.

On July 14, about 9:30 p. m. a small tornado moved from a mile and a half northwest of Weston, Pottawattamie county, to a half mile west of that town, causing \$600 worth of damage.

Pressure. The mean pressure (reduced to sea level) for the State was 30.02 inches. The highest pressure recorded was 30.31 inches, at Dubuque on the 12th, and the lowest was 29.65 at Sioux City on the 3d. The monthly range was 0.66 of an inch.

Temperature. The mean temperature for the State, as shown by the records of 100 stations, was 73.1°, or 1.0° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 71.2° or 1.5° lower than the normal; Central, 73.0° or 1.3° lower than the normal; Southern, 75.0°, or 0.2° lower than the normal. The highest monthly mean was 78.0° at Corning, and the lowest was 68.6°, at Postville. The highest temperature reported was 105°, at Clarinda, on the 28th; the lowest was 40°, at Audubon, on the 1st. The temperature range for the State was 65°.

Humidity. The average relative humidity for the State at 7 a. m. was 77 per cent, and at 7 p. m. it was 56 per cent. The mean for the State was 66 per cent, or 1 per cent lower than the normal. The highest monthly mean was 74 per cent, at Sioux City, and the lowest was 58 per cent at Omaha, Nebr.

Precipitation. The average precipitation for the State, as shown by the records of 108 stations, was 3.17 inches, or 0.79 inch less than the normal. By divisions the averages were as follows: Northern, 4.57 inches, or 0.69 inch more than the normal; Central, 3.00 inches, or 0.96 inch less than the normal; Southern, 1.93 inches, or 2.09 inches less than the normal. The greatest amount, 8.05 inches, occurred at Postville, and the least 0.26 of an inch at Albia. The greatest amount in 24 consecutive hours, 3.62 inches, occurred at Charles City on the 25th and 26th.

Wind. The prevailing direction of the wind was from the southeast. The highest velocity reported from a regular Weather Bureau station was 41 miles an hour, from the south, at Sioux City, on the 3d.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 72, or 2 per cent less than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 65; Davenport, 73; Des Moines, 78; Dubuque, 74; Keokuk, 80; Sioux City, 64; Omaha, Nebr., 71.

Miscellaneous Phenomena. Aurora, 10th. Fog, 5th, 6th, 15th, 16th, 17th, 25th. Hail, Northern Division, 22d, 25th, 26th; Southern Division, 27th, 28th. Halo (lunar 22d; solar 1st, 14th, 16th, 17th, 27th). Rainbow (lunar), at Grinnell on the 25th. Thunderstorms, 2d, 3d, 4th, 5th, 6th, 7th, 9th, 14th, 15th, 19th, 21st, 22d, 23d, 24th, 25th, 26th, 27th, 28th, 29th, 31st. Tornado, 14th.

Rivers. The principal rivers fell steadily during the month except when affected temporarily by heavy rainfall. Moderate stages for July prevailed on the Missouri and low stages on the Mississippi. None of the streams in the interior of the State were overflowed and low stages prevailed generally.

COMPARATIVE DATA FOR THE STATE—JULY.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	75.6	+ 1.5	110	45	1.98	−1.98	5.00	0.37	-----	3	18	8	5
1891-----	68.5	− 5.6	99	41	4.22	+0.26	8.20	1.67	-----	8	13	13	5
1892-----	73.0	− 1.1	104	38	5.29	+1.33	12.86	1.71	-----	9	16	10	5
1893-----	75.0	+ 0.9	102	47	3.33	−0.63	8.84	1.49	-----	7	19	10	2
1894-----	76.4	+ 2.3	109	39	0.63	−3.33	3.50	T.	-----	3	22	8	1
1895-----	72.1	− 2.0	104	35	3.40	−0.56	10.10	0.45	-----	7	15	12	4
1896-----	73.6	− 0.5	104	42	6.90	+2.94	12.67	1.61	-----	9	14	11	6
1897-----	75.6	+ 1.5	100	42	3.26	−0.70	7.60	1.01	-----	6	18	10	3
1898-----	73.4	− 0.7	102	42	2.98	−0.93	12.88	0.55	-----	7	19	9	3
1899-----	73.1	− 1.0	101	38	3.07	−0.89	8.66	0.42	-----	7	16	10	5
1900-----	73.4	− 0.7	102	37	6.15	+2.19	18.45	1.80	-----	9	16	10	5
1901-----	82.4	+ 8.3	113	46	2.34	−1.62	5.97	0.27	-----	5	21	9	1
1902-----	73.1	− 1.0	99	41	8.67	+4.71	13.57	4.82	-----	13	14	10	7
1903-----	72.9	− 1.2	100	40	4.83	+0.87	12.72	0.94	-----	9	17	9	5
1904-----	70.6	− 3.5	100	38	4.41	+0.45	11.97	1.28	-----	10	16	9	6
1905-----	70.6	− 3.5	102	40	2.91	−1.05	7.08	0.69	-----	9	14	10	7
1906-----	70.9	− 3.2	102	42	3.04	−0.92	7.05	0.26	-----	8	18	10	3
1907-----	73.7	− 0.4	102	41	7.27	+3.31	13.66	3.97	-----	13	16	11	4
1908-----	73.0	− 1.1	100	42	3.66	−0.30	9.21	0.70	-----	8	16	10	5
1909-----	72.3	− 1.8	102	46	4.77	+0.81	12.20	1.20	-----	10	15	8	8
1910-----	74.5	+ 0.4	108	43	1.86	−2.10	5.69	0.12	-----	7	19	8	4
1911-----	75.5	+ 1.4	111	38	2.27	−1.69	6.62	0.08	-----	7	18	10	3
1912-----	74.6	+ 0.5	103	33	3.71	−0.25	7.56	1.17	-----	10	17	10	4
1913-----	76.1	+ 2.0	108	45	1.82	−2.14	6.23	T.	-----	5	21	8	2
1914-----	76.6	+ 2.5	109	43	2.27	−1.69	6.50	0.44	-----	5	20	8	3
1915-----	69.5	− 4.6	92	40	8.32	+4.36	15.83	3.68	-----	14	10	12	9
1916-----	79.7	+ 5.6	105	48	1.78	−2.18	6.87	0.10	-----	5	23	7	1
1917-----	74.3	+ 0.2	106	38	2.27	−1.69	6.06	0.23	-----	7	21	8	2
1918-----	73.1	− 1.0	105	40	3.17	−0.79	8.05	0.26	-----	8	19	8	4

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

AUGUST.

On August 4th-5th high temperature records, covering periods of 40 to 46 years at some stations, were broken. The highest reported was 113° at Clarinda, Knoxville and Shenandoah on the 4th, which equals the absolute maximum for the State that occurred at Sigourney on July 22, 1901. The monthly mean for the State, 76.0°, though 4.2° above normal, was exceeded in August, 1900, 1909 and 1913. The excess in temperature was greatest, 8.0°, in Adams county where the greatest damage to corn occurred. Precipitation was deficient from the Missouri River eastward over the central counties extending in a narrow belt to the middle Mississippi. The deficiency exceeded 3 inches in Monona, Fremont and Webster Counties; and in the extreme southwest counties from March 1 to August 31 is more than 50% of the normal.

The corn crop had been somewhat injured by drouth prior to August in the southwest one-third of the State and was in poor condition to withstand the withering heat, strong southerly winds and low humidity which were at a climax August 4-6 and were somewhat damaging in localities till general showers came about the middle of the month. As a whole, the crop deteriorated 11 per cent or about 35,000,000 bushels. In Adams County where the worst damage is reported, the crop will be only 20 per

cent of the normal. Much livestock was sold in the southwest counties because of shortage of feed and that which remained was on winter feed throughout the month. Excessive rains with unusually severe electrical storms in the north and east-central counties on the 16th-17th damaged shocked grain and delayed threshing.

Pressure. The mean pressure (reduced to sea level) for the State was 29.93 inches. The highest recorded was 30.30 inches, at Dubuque, on the 19th, and the lowest was 29.58 inches, at Sioux City, on the 5th. The monthly range was 0.72 of an inch.

Temperature. The mean temperature for the State, as shown by the records of 102 stations, was 76.0°, or 4.2° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 72.8°, or 2.4 higher than the normal; Central, 76.1°, or 4.4° higher than the normal; Southern, 79.1°, or 5.9° higher than the normal. The highest monthly mean was 80.8°, at Clarinda, Keokuk, Thurman and Omaha, Nebr., and the lowest was 70.0°, at Forest City. The highest temperature recorded was 113°, at Clarinda, Knoxville and Shenandoah, on the 4th, and the lowest was 38°, at Sibley, on the 30th. The temperature range for the State was 75°.

Precipitation. The average precipitation for the State, as shown by the normal. By divisions the averages were as follows: Northern, 4.32 records of 112 stations, was 3.61 inches, 0.07 of an inch less than the inches, or 0.84 of an inch more than the normal; Central, 2.97 inches, or 0.80 of an inch less than the normal; Southern, 3.55 inches, or 0.23 of an inch less than the normal. The greatest amount 8.38 inches, occurred at Centerville, and the least, 0.54 of an inch, at Thurman. The greatest amount in 24 hours 5.22 inches, occurred at Dubuque on the 16th-17th.

Humidity. The average relative humidity for the State at 7 a. m. was 77 per cent, and at 7 p. m. it was 58 per cent. The mean for the month was 67 per cent, or 4 per cent lower than the normal. The highest monthly mean was 76 per cent, at Charles City, and the lowest was 56 per cent, at Omaha, Nebr.

Wind. The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 51 miles an hour, from the south, at Sioux City, on the 15th.

Sunshine. The average per cent of the possible amount of sunshine was 68, or 3 per cent less than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 63; Davenport, 69; Des Moines, 62; Dubuque, 66; Keokuk, 76; Sioux City, 68; Omaha, Nebr., 70.

Miscellaneous Phenomena. Aurora, 17th, 24th, 25th, 26th and 31st. Fog, 9th, 14th, 16th, 24th, 27th and 28th. Frost, (light): 31st, at Mt. Ayr. Hail: 14th, 17th, 22d, 29th and 30th. Halo, Solar: 27th. Rainbow: 22d. Thunderstorms. All days except 5th, 9th, 24th, 25th, 26th, 27th and 31st.

Rivers. Moderate stages prevailed on the Missouri River, with a general falling tendency the greater portion of the month; on the Mississippi low stages prevailed, with a falling tendency, until the 17th, when a sharp rise, due to unusually heavy rainfall over the northeastern portion of the

State, occurred. Crest stages occurred at Dubuque on the 18th, at Davenport on the 19th and at Keokuk on the 21st. At the end of the month low stages were general on the Mississippi. The interior rivers were low except for brief periods.

COMPARATIVE DATA FOR THE STATE—AUGUST.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890.....	68.4	— 3.4	102	36	3.41	—0.27	6.44	1.02	-----	8	15	10	6
1891.....	69.1	— 2.7	106	34	4.24	—0.56	13.02	1.23	-----	8	13	12	6
1892.....	71.4	— 0.4	102	40	2.24	—1.34	4.69	0.65	-----	5	18	9	4
1893.....	69.4	— 2.4	101	30	2.32	—1.26	6.22	0.40	-----	5	19	9	3
1894.....	74.6	+ 2.8	108	38	1.58	—2.10	4.53	T.	-----	4	21	8	2
1895.....	71.9	+ 0.1	103	37	4.43	+0.75	10.63	0.67	-----	7	17	9	5
1896.....	71.7	— 0.1	104	34	3.52	—0.16	12.25	0.86	-----	8	15	11	5
1897.....	68.9	— 2.9	104	35	1.86	—1.82	4.98	0.47	-----	6	15	11	5
1898.....	71.2	— 0.6	103	40	3.44	—0.24	10.55	0.58	-----	6	17	9	5
1899.....	74.4	+ 2.6	100	41	3.68	0.00	10.45	1.12	-----	7	17	10	4
1900.....	77.4	+ 5.6	103	44	4.65	+0.97	10.43	1.26	-----	6	18	10	3
1901.....	73.8	+ 2.0	105	40	1.29	—2.39	4.46	T.	-----	5	20	9	2
1902.....	69.1	— 2.7	98	37	6.58	+2.90	15.47	1.57	-----	11	11	11	9
1903.....	69.1	— 2.7	101	41	6.64	+2.96	17.74	2.55	-----	11	12	10	9
1904.....	69.1	— 2.7	97	35	3.43	—0.25	6.75	0.66	-----	7	17	8	6
1905.....	74.3	+ 2.5	104	44	4.05	+0.37	8.47	1.04	-----	9	16	9	6
1906.....	74.1	+ 2.3	101	33	3.95	+0.27	10.51	0.92	-----	9	17	9	5
1907.....	71.1	— 0.7	99	37	4.33	+0.65	9.67	1.05	-----	9	17	9	5
1908.....	70.0	— 1.8	101	38	4.77	+1.09	10.55	1.35	-----	9	17	9	5
1909.....	76.1	+ 4.3	103	33	1.81	—1.87	8.21	T.	-----	5	21	8	2
1910.....	71.9	+ 0.1	104	36	3.88	+0.20	11.22	0.37	-----	8	15	10	6
1911.....	71.7	— 0.1	107	34	3.32	—0.36	9.47	0.44	-----	9	16	10	5
1912.....	71.0	— 0.8	101	40	3.78	+0.10	7.90	0.89	-----	10	15	10	6
1913.....	76.6	+ 4.8	108	40	2.68	—1.00	7.13	0.08	-----	6	17	10	4
1914.....	73.7	+ 1.9	103	40	2.19	—1.49	4.90	0.42	-----	7	17	10	4
1915.....	65.9	— 5.9	91	30	2.81	—0.87	9.04	0.27	-----	8	16	8	7
1916.....	74.0	+ 2.2	106	35	2.58	—1.10	6.23	0.49	-----	7	18	9	4
1917.....	69.4	— 2.4	102	31	2.29	—1.39	6.31	0.70	-----	7	19	8	4
1918.....	76.0	+ 4.2	113	38	3.61	—0.07	8.38	0.54	-----	8	16	10	5

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

SEPTEMBER.

September mean temperature, 58.6°, is the lowest of 29 Septembers, except 1896, which was only 0.1° cooler. The deficiency in temperature was greatest, 8°, in the extreme northeast portion and least, 2.6°, in Adams County. The temperature was normal or higher on very few days. During the coolest period, 18th-21st, heavy to killing frosts covered all sections of the State except a distance of about 50 miles west of the Mississippi River, and frosts reached most of the east-central counties on the 27th. Precipitation was deficient except in Floyd and surrounding counties where heavy rains on the 10th caused a monthly excess; also in Wapello and adjacent counties where heavy rains fell on the 2d and 4th.

Due to the great damage by frost last year, the seed corn available for planting this season was limited largely to the earlier varieties. This, together with a favorable season, left little corn subject to damage by the early frosts. That planted after the June floods suffered most.

The garden vegetable season was shortened about three weeks. The dry weather favored the maturing of corn but interfered considerably with the seeding and germination of wheat and rye. Where the moisture was sufficient these crops were up and growing nicely at the close of the month.

Pressure. The mean pressure (reduced to sea level) for the State was 30.09 inches. The highest recorded was 30.51 inches at Dubuque, on the 10th, and the lowest was 29.70 at Davenport, on the 14th. The monthly range was 0.81 inch.

Temperature. The mean temperature for the State, as shown by the records of 96 stations was 58.6°, or 4.8° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 56.7°, or 5.1° lower than the normal; Central, 58.5°, or 5.0° lower than the normal; Southern, 60.5° or 4.5° lower than the normal. The highest monthly mean was 62.4°, at Omaha, Nebr., and the lowest 54.0°, at Postville. The highest temperature reported was 93° at Omaha, Nebr., on the 18th, and the lowest, 21° at Denison, on the 21st. The temperature range for the State was 73°.

Humidity. The average relative humidity for the State at 7 a. m. was 79 per cent and at 7 p. m. 58 per cent. The mean for the month was 68 per cent, which is 6 per cent below normal. The highest monthly mean was 83 per cent at Charles City, and the lowest was 69 per cent at Omaha, Nebr.

Precipitation. The average precipitation for the State, as shown by the records of 108 stations, was 1.87 inches, or 1.49 inches below the normal. By divisions the averages were as follows: Northern, 1.83 inches, or 1.22 inches less than the normal; Central, 1.46 inches, or 2.00 inches less than the normal; Southern, 2.32 inches, or 1.24 inches less than the normal. The greatest amount, 4.62, occurred at Keosauqua, and the least, 0.48 inch, at Cumberland. The greatest amount in 24 consecutive hours 2.82 inches, occurred at Keosauqua, on the 2d.

Wind. The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 34 miles an hour from the northwest at Sioux City, on the 11th, and at Des Moines from the southwest, on the 17th.

Sunshine. The average per cent of the possible amount of sunshine was 63, which is normal. The per cent of the possible amount at regular Weather Bureau stations was as follows: Charles City, 61; Davenport, 56; Des Moines, 60; Dubuque, 55; Keokuk, 75; Sioux City, 65; Omaha, Nebr., 68.

Miscellaneous Phenomena. Aurora, 1st, 21st, 29th, 30th. Fog, dense, 8th, 11th, 12th, 14th, 25th, 27th. Frost, killing, Northern Division, 12th, 16th, 17th, 18th, 19th, 20th, 21st; Central Division, 17th, 18th, 20th, 21st, 27th; Southern Division, 17th, 20th, 21st. Hail, 10th, 11th, 18th, 19th, 20th. Halo (lunar or solar) 17th. Thunderstorms, 1st, 2d, 9th, 10th, 11th, 12th, 14th, 15th, 17th, 18th, 19th, 24th, 25th.

COMPARATIVE DATA FOR THE STATE—SEPTEMBER.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890	59.3	— 4.1	96	23	2.97	—0.39	4.85	1.36	-----	7	13	10	7
1891	67.3	+ 3.9	104	28	1.33	—2.06	3.60	0.13	-----	4	20	7	3
1892	64.7	+ 1.3	99	29	1.53	—1.83	4.15	0.16	-----	4	16	8	6
1893	64.7	+ 1.3	102	18	2.34	—1.02	5.49	0.74	-----	4	20	6	4
1894	65.1	+ 1.7	100	26	3.57	+0.21	7.43	0.67	-----	8	15	10	5
1895	66.8	+ 3.4	103	22	3.03	—0.33	7.43	0.85	-----	5	18	8	4
1896	58.5	— 4.9	95	22	4.09	+0.73	9.96	1.82	-----	10	11	9	10
1897	70.9	+ 7.5	106	26	2.04	—1.32	5.88	0.00	-----	4	23	5	2
1898	65.3	+ 1.9	99	29	2.69	—0.67	8.45	0.41	-----	7	16	9	5
1899	62.5	— 0.9	104	15	0.93	—2.43	4.32	T.	-----	4	16	9	5
1900	64.4	+ 1.0	99	26	4.98	+1.62	8.82	2.48	-----	9	15	8	7
1901	63.3	— 0.1	102	26	4.77	+1.41	13.62	1.71	-----	9	13	9	8
1902	59.1	— 4.3	88	23	4.35	+0.99	10.41	1.65	-----	9	15	6	9
1903	60.8	— 2.6	94	28	3.81	+0.45	8.79	1.42	-----	10	14	6	10
1904	64.0	+ 0.6	94	30	2.78	—0.58	8.33	0.09	-----	7	13	8	9
1905	65.8	+ 2.4	96	36	3.81	+0.45	13.18	0.50	-----	8	14	8	8
1906	67.2	+ 3.8	100	27	4.16	+0.80	11.10	0.64	-----	8	16	8	6
1907	62.8	— 0.6	98	25	2.75	—1.61	6.06	1.38	-----	8	15	9	6
19 8	67.9	+ 4.5	98	20	1.20	—2.16	3.46	0.25	-----	3	21	6	3
1909	62.4	— 1.0	94	30	3.58	+0.22	7.34	1.39	-----	9	14	8	8
1910	63.2	— 0.2	99	30	3.59	+0.23	7.43	1.18	-----	9	14	7	9
1911	65.8	+ 2.4	103	32	5.12	+1.76	13.73	1.19	-----	10	11	9	10
1912	62.1	— 1.3	104	24	3.98	+0.62	10.12	0.28	-----	11	12	8	10
1913	64.5	+ 1.1	107	19	3.31	—0.05	7.44	0.45	-----	9	15	8	7
1914	64.5	+ 1.1	99	30	7.88	+4.52	16.24	2.48	-----	10	16	7	7
1915	63.7	+ 0.3	91	30	6.03	+2.67	12.45	2.88	-----	11	11	8	11
1916	62.5	— 0.9	98	21	3.89	+0.53	9.71	1.45	-----	7	17	8	5
1917	62.6	— 0.8	97	28	2.90	—0.46	8.68	0.39	-----	7	15	7	8
1918	58.6	— 4.8	93	20	1.87	—1.49	4.62	0.48	-----	6	16	8	6

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

OCTOBER.

October was generally warm and pleasant, but with cool periods on the 1st, 24th-26th, and 30th-31st. From the 8th to the 17th the weather was unusually warm. The first killing frost of the season occurred in the extreme eastern counties on the 27th, the rest of the State having had killing frosts in September. Precipitation was well distributed both as to time and area but slightly below normal till a storm center of marked intensity crossed the State from south to north on the 27th, causing heavy to excessive rains, 26th-28th. In the northwest part of the State the precipitation on the 26th was largely in the form of snow.

Corn dried out rapidly and husking and cribbing began early and progressed rapidly. A largely increased acreage of winter wheat in the winter wheat sections of the State made excellent growth. Potato digging was finished and the crop is generally small.

An unusually brilliant aurora was observed during the night of the 8th-9th at Oskaloosa and some other stations.

Pressure. The mean pressure (reduced to sea level) for the State was 30.03 inches. The highest recorded was 30.44 inches, at Dubuque, on the 3d, and lowest was 29.17 inches at Des Moines, on the 27th. The monthly range was 1.27 inches.

Temperature. The mean temperature for the State, as shown by the records of 100 stations, was 55.1° , or 4.3° , higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 52.8° , or 3.8° higher than the normal; Central, 55.5° , or 4.6° higher than the normal; Southern, 57.0° , or 4.4° higher than the normal. The highest monthly mean was 59.0° , at Afton, and the lowest was 50.2° at Northwood. The highest temperature reported was 93° , at Shenandoah, on the 12th; the lowest was 21° , at Sibley, on the 29th. The temperature range for the State was 72° .

Humidity. The average relative humidity for the State at 7 a. m. was 82 per cent, and at 7 p. m. it was 63 per cent. The mean for the month was 72 per cent, or 1 per cent greater than the normal. The highest monthly mean was 78 per cent, at Charles City, and the lowest was 69 per cent at Omaha, Nebr. At Des Moines, the remarkably low humidity of 10 per cent was observed at 1:45 P. M. of the 16th.

Precipitation. The average precipitation for the State, as shown by the records of 110 stations, was 3.64 inches, or 1.18 inches greater than the normal. By divisions the averages were as follows: Northern, 3.34 inches, or 1.00 inch greater than the normal; Central, 3.71 inches, or 1.22 inches greater than the normal; Southern, 3.87 inches, or 1.33 inches greater than the normal. The greatest amount, 7.56 inches, occurred at Thurman, and the least, 1.36 inches, occurred at Mt. Pleasant. The greatest amount in 24 consecutive hours, 3.27 inches, occurred at Boone on the 27th.

Snow. General snow occurred in the northwest portion of the State on the 26th and at its maximum totaled 6 inches over a belt extending from Monona and Woodbury counties to Dickinson and Emmet counties. The snow was soon melted by the heavy rain that followed.

Wind. The prevailing direction of the wind was south. The highest velocity reported from a regular Weather Bureau station was 37 miles per hour, from the south, at Keokuk, on the 27th.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 52, or 9 per cent less than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 48; Davenport, 45; Des Moines, 50; Dubuque, 57; Keokuk, 61; Sioux City, 53; Omaha, Nebr., 47.

Miscellaneous Phenomena. Aurora, 8th, 9th, 12th, 16th. Fog, 1st, 2d, 9th, 12th. Halos, Solar, 2d, 9th, 17th, 24th. Halos, Lunar, 15th, 16th, 17th, 21st, 24th. Rainbow, 8th. Sleet, 25th, 26th, 27th, 30th, 31st. Smoke, 17th. Thunderstorms, 7th, 8th, 27th, 28th. Killing Frosts, Northern Division, 3d, 25th, 30th; Central Division, 14th, 25th, 26th, 28th, 31st; Southern Division, 28th.

COMPARATIVE DATA FOR THE STATE—OCTOBER.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890.....	49.2	— 1.6	86	16	3.48	+1.02	6.82	1.59	-----	7	11	11	9
1891.....	50.0	— 0.8	92	19	2.77	+0.31	6.53	0.85	-----	6	18	7	6
1892.....	54.5	+ 3.7	96	14	1.55	—0.91	2.58	0.00	0.0	4	21	6	4
1893.....	52.4	+ 1.6	94	10	1.28	—1.18	4.56	0.02	0.0	4	16	9	6
1894.....	51.7	+ 0.9	90	20	2.67	+0.21	5.25	0.03	0.2	8	14	8	9
1895.....	46.0	— 4.8	88	4	0.47	—1.99	1.38	0.00	T.	2	19	8	4
1896.....	47.9	— 2.9	88	12	3.13	+0.67	5.05	1.51	T.	5	18	6	7
1897.....	56.8	+ 6.0	97	12	1.14	—1.32	3.30	0.03	0.0	4	17	8	6
1898.....	47.5	— 3.3	88	17	3.56	+1.10	5.75	1.27	3.6	8	7	9	15
1899.....	56.7	+ 5.9	95	17	1.73	—0.73	4.64	0.15	0.0	5	17	8	6
1900.....	59.3	+ 8.5	90	21	3.91	+1.45	8.00	1.20	0.0	7	16	7	8
1901.....	54.2	+ 3.4	88	20	1.98	—0.48	4.23	0.45	T.	6	17	7	7
1902.....	53.5	+ 2.7	83	20	2.54	+0.08	6.66	0.28	T.	5	16	8	7
1903.....	52.2	+ 1.4	90	16	1.95	—0.51	4.50	0.32	0.0	5	19	6	6
1904.....	53.1	+ 2.3	96	16	1.67	—0.79	4.43	0.14	T.	6	15	8	8
1905.....	49.2	— 1.6	95	16	3.40	+0.94	5.36	1.20	1.6	8	16	6	9
1906.....	50.5	— 0.3	87	7	1.96	—0.50	4.25	0.50	0.1	6	14	7	10
1907.....	50.4	— 0.4	85	10	1.50	—0.96	3.71	0.30	0.0	5	20	5	6
1908.....	51.1	+ 0.3	89	17	3.38	+0.92	8.83	0.58	2.6	8	16	6	9
1909.....	49.7	— 1.1	97	10	2.22	—0.24	4.70	0.48	T.	6	16	6	9
1910.....	55.2	+ 4.4	93	10	0.77	—1.69	1.73	T.	0.1	4	21	4	6
1911.....	48.7	— 2.1	87	14	3.34	+0.88	7.03	0.73	0.6	10	12	8	11
1912.....	52.2	+ 1.4	92	16	2.98	+0.52	5.77	1.03	T.	6	21	3	7
1913.....	49.2	— 1.6	89	—2	3.03	+0.57	7.29	0.35	1.2	9	15	8	8
1914.....	55.9	+ 5.1	88	14	3.23	+0.77	6.64	0.74	T.	9	16	6	9
1915.....	54.4	+ 3.6	86	19	1.31	—1.15	3.25	—T.	T.	5	19	6	6
1916.....	50.9	+ 0.1	92	6	2.00	—0.46	4.33	0.20	2.0	8	16	7	8
1917.....	42.9	— 7.9	85	0	1.41	—1.05	4.00	0.15	2.2	6	10	11	10
1918.....	55.1	+ 4.3	93	21	2.64	+1.18	7.56	1.36	0.8	7	13	7	11

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

NOVEMBER.

Mild temperature prevailed particularly from the 2d to the 19th, though cool, 23d-26th. Precipitation was well distributed both as to time and area, and was above normal in all but the east-central and some extreme northeast counties and portions of Boone, Dallas and Adair counties. Most of the precipitation occurred in the heavy rain and snow storm of Thanksgiving Day, the 28th. Part of the snow lay on the ground at the close of the month, except in the northwest.

Corn husking progressed rapidly, 91 per cent being finished; yield slightly below normal; quality, excellent, only 4 per cent being soft. There was abundant moisture and warmth for winter wheat which made good growth and is entering the winter in excellent condition, 95 per cent having become well established. Because of labor shortage, less than the usual amount of fall plowing was done.

Pressure. The mean pressure (reduced to sea level) for the State was 30.04 inches. The highest recorded was 30.70 inches, at Sioux City, on the 23d, and the lowest was 29.03 inches, at Davenport, on the 28th. The monthly range was 1.67 inches.

Temperature. The mean temperature for the State, as shown by the records of 102 stations was 39.9° , or 4.9° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 38.1° , or 5.3° higher than the normal; Central, 40.0° , or 4.9° higher than the normal; Southern, 41.5° , or 4.4° higher than the normal. The highest monthly mean was 43.8° , at Keokuk, and the lowest was 36.0° , at Mason City and Sibley. The highest temperature recorded was 76° at Bloomfield, Fairfield, Keosauqua, Ottumwa, Stockport and Washington, on the 6th, and the lowest, zero, at Mason City, on the 25th. The temperature range for the State was 76° .

Humidity. The average relative humidity for the State at 7 a. m. was 84 per cent and at 7 p. m. 71 per cent. The mean for the month was 78 per cent, which is 4 per cent above the normal. The highest mean was 84 per cent at Charles City, and the lowest, 74 per cent, at Dubuque and Keokuk.

Precipitation. The average precipitation for the State, as shown by the records of 109 stations, was 2.11 inches, or 0.60 inch above the normal. By divisions the averages were as follows: Northern, 2.36 inches, or 0.95 inch greater than the normal; Central, 1.84 inches, or 0.31 inch greater than the normal; Southern, 2.13 inches, or 0.55 inch greater than the normal. The greatest amount, 5.10 inches, occurred at Northwood, and the least, 0.70 inch, at Cedar Rapids. The greatest amount in 24 consecutive hours, 2.07 inches, occurred at Sibley on the 16th.

Snowfall. The average fall for the State was 4.4 inches, which is 1.9 inches more than the normal. The heaviest fall was 9.5 inches at Fayette. Practically the entire fall of snow occurred on the 27th and 28th when one of the largest November snows on record occurred over a large portion of the State. The snowfall was light over the northwest and southeast portions, a few stations reporting only traces.

Wind. The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 49 miles per hour, from the northwest, at Sioux City, on the 17th.

Sunshine. The average per cent of the possible amount of sunshine was 52, or 4 per cent less than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 44; Davenport, 49; Des Moines, 51; Dubuque, 55; Keokuk, 59; Sioux City, 50; Omaha, Nebr., 53. There was an unusual period of almost continuous cloudiness 15th-23d.

Miscellaneous Phenomena. Aurora, 10th, 11th, 29th, 30th. Fog, dense, 2d, 3d, 4th, 5th, 7th, 10th, 15th, 16th, 17th, 26th. Hail, 7th, 16th, 18th, 21st. Halo, lunar, 12th. Halo, solar, 2d, 12th. Rainbow, 16th. Sleet, 17th, 20th, 21st, 27th, 28th. Thunderstorms, 3d, 6th, 8th, 16th, 17th, 18th.

COMPARATIVE DATA FOR THE STATE—NOVEMBER.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	38.6	+ 3.6	78	-- 2	1.46	—0.05	3.55	0.71	-----	3	15	8	7
1891-----	30.5	— 4.5	84	—24	1.70	+0.19	3.64	0.06	-----	7	10	8	12
1892-----	33.3	— 1.7	70	— 3	1.10	—0.41	3.16	0.05	1.8	4	11	8	11
1893-----	34.0	— 1.0	86	—13	1.17	—0.34	2.56	0.05	4.6	4	16	8	6
1894-----	32.7	— 2.3	72	— 5	0.92	—0.59	2.42	T.	0.4	4	9	11	10
1895-----	34.3	— 0.7	86	—12	1.51	0.00	3.01	0.45	4.9	6	9	8	13
1896-----	29.6	— 5.4	82	—15	1.83	+0.32	4.51	0.16	2.9	6	9	8	13
1897-----	34.3	— 0.7	81	—19	0.66	—0.85	2.24	T.	1.2	5	12	8	10
1898-----	32.2	— 2.8	78	—17	1.50	—0.01	3.61	0.33	8.7	6	14	8	8
1899-----	43.9	+ 8.9	86	8	1.20	—0.31	2.97	0.13	0.5	5	12	8	10
1900-----	33.5	— 1.5	79	— 6	1.06	—0.45	3.35	T.	3.7	6	12	7	11
1901-----	35.8	+ 0.8	77	2	0.86	—0.65	2.30	0.20	2.6	3	18	6	6
1902-----	41.2	+ 6.2	79	4	2.13	+0.62	4.19	0.16	1.8	7	9	7	14
1903-----	34.2	— 0.8	76	— 5	0.52	—0.99	1.74	T.	1.1	3	13	8	9
19 4-----	41.0	+ 6.0	80	4	0.15	—1.36	0.50	0.00	0.5	1	20	6	4
1905-----	38.4	+ 3.4	70	—12	2.84	+1.33	5.30	0.90	0.6	5	16	7	7
1906-----	35 4	+ 0.4	76	— 5	2.03	+0.52	3.86	0.35	4.4	8	9	7	14
1907-----	36.7	+ 1.7	68	— 4	1.03	—0.48	2.27	0.05	0.9	4	17	6	7
1908-----	39.3	+ 4.3	80	5	1.56	+0.05	3.31	0.21	1.4	5	14	7	9
1909-----	42.4	+ 7.4	84	— 3	5.39	+3.88	11.48	2.07	6.8	10	10	7	13
1910-----	33.4	— 1.6	76	5	0.34	—1.17	1.03	T.	0.7	3	13	9	8
1911-----	29.9	— 5.1	79	— 8	1.42	—0.09	4.99	0.11	1.6	6	11	8	11
1912-----	40.1	+ 5.1	77	6	0.98	—0.53	2.38	0.00	T.	2	18	8	4
1913-----	44.1	+ 9.1	78	10	1.18	—0.33	3.49	0.20	0.4	6	11	7	12
1914-----	41.0	+ 6.0	80	— 4	0.22	—1.29	0.95	0.00	T.	2	19	6	5
1915-----	40.2	+ 5.2	83	— 5	1.94	+0.43	4.86	0.30	1.2	6	11	10	9
1916-----	37.3	+ 3.3	80	— 8	1 61	+0.10	3.65	0.05	3.6	5	16	6	8
1917-----	40.7	+ 5 7	77	13	0.28	—1.23	1.02	T.	1.4	3	14	6	10
1918-----	39.9	+ 4.9	76	6	2.11	+0.60	5.10	0.70	4.4	7	13	5	12

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

DECEMBER.

This was the warmest December in the 29 years state-wide records have been compiled and was in striking contrast with December, 1917, which was the coldest. The excess in temperature was rather evenly distributed over the State and averaged 8.8 degrees. Precipitation was evenly distributed and slightly above normal, the largest excesses being in the southeast counties, particularly portions of Mahaska, Louisa and Van Buren. Deficiencies occurred in the west-central counties and north-east to the Mississippi River.

Frost left the ground early in the month. The mild weather with precipitation above normal through the fall put roads in the worst condition in many years. As they were practically impassible for heavy traffic, comparatively little corn or other farm produce was marketed. Aside from this, outdoor occupations made unusual progress; fall plowing which had been delayed by labor shortage was brought up to or above normal, continuing in the north till the 21st, and in the south till the 24th; and corn husking was practically finished. Winter wheat made good growth and was pastured some in the southwest to check over-growth. Heavy snow covered the southeastern part of the state on the 24th, amounting to a foot or more in several counties. The ground was not frozen when the grow-

ing wheat was covered with this heavy snow blanket. While this is generally believed to be a favorable condition, some adverse opinion has been expressed. If the snow remains porous and does not become converted into an impervious ice sheet by thawing, harm can scarcely result. Fruit buds, though slightly swelled in the south, are believed to be generally safe. Dandelions bloomed in the extreme southeast. Fuel and feed were saved. Livestock subsisted out of doors and was in good condition generally, except hogs which were widely afflicted with influenza, which caused thinness but little mortality. A cold wave preceded by general snow was sweeping southeastward over the State at the close of the month.

Pressure. The mean pressure (reduced to sea level) for the State was 30.04 inches. The highest recorded was 30.51 inches, at Dubuque, on the 18th and at Sioux City on the 23d, and the lowest was 29.29 inches at Sioux City on the 9th. The monthly range was 1.22 inches.

Temperature. The mean temperature for the State, as shown by the means of 98 stations, was 32.7° , or 8.8° higher than the normal. By divisions, three tiers of counties to the division, the mean temperatures were as follows: Northern, 30.5° , or 9.3° higher than the normal; Central, 32.8° , or 8.7° higher than the normal; Southern, 34.7° , or 8.3° higher than the normal. The highest monthly mean was 37.8° at Keokuk, and the lowest monthly mean was 28.9° at Postville. The highest temperature reported was 68° at Columbus Junction on the 8th, and the lowest temperature reported was -7° , at Maquoketa, on the 26th, and at Thurman on the 25th, the range for the State being 75° .

Humidity. The average relative humidity for the State at 7 a. m. was 86 per cent, and at 7 p. m. it was 79 per cent. The mean for the month was 82 per cent, or about 2 per cent above normal. The highest monthly mean was 89 per cent at Charles City, and the lowest reported was 78 per cent, at Keokuk and at Omaha, Nebr.

Precipitation. The average precipitation for the State, as shown by the records of 105 stations, was 1.30 inches, or 0.08 inch more than the normal. By divisions, the averages were as follows: Northern, 1.11 inches, or 0.04 inch more than the normal; Central, 1.24 inches, or 0.01 inch less than the normal; Southern, 1.55 inches, or 0.08 inch more than the normal. The greatest amount, 3.30 inches, occurred at Oskaloosa, and the least, 0.37 inch at LeMars. The greatest amount in any 24 consecutive hours, 1.55 inches, occurred at Oskaloosa, on the 24th.

Snow. The average snowfall for the state was 5.1 inches, or 1.1 inches below normal. The greatest amount, 16.3 inches, occurred at Columbus Junction, and the least, a trace, at 5 stations.

Wind. The prevailing direction of the wind was from the northwest. The highest velocity reported was at the rate of 49 miles an hour from the northwest, at Sioux City, on the 31st.

Sunshine and Cloudiness. The average per cent of the possible amount of sunshine was 38 per cent, or about 10 per cent less than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 23; Davenport, 34; Des Moines, 40; Dubuque, 34; Keokuk, 54; Sioux City, 41; and Omaha, Nebr., 40 per cent. The average number of clear days was 9; partly cloudy, 8; cloudy, 14.

Miscellaneous Phenomena. Aurora, 2d, 7th, 8th, 25th, 29th, 31st. Fog, 1st, 8th, 9th, 10th, 12th, 13th, 14th, 16th, 17th, 18th, 19th, 20th, 21st, 22d, 29th, 30th. Hail, 1st, 30th. Halos (lunar or solar), 1st, 2d, 7th, 15th, 16th, 17th, 19th, 25th, 31st. Parhelia, 31st. Sleet, 1st, 30th. Thunderstorms, 2d, 8th, 9th.

COMPARATIVE DATA FOR THE STATE—DECEMBER.

YEAR	Temperature				Precipitation					Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snowfall	With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890-----	29.1	+ 5.2	72	—18	0.45	—0.77	1.40	0.00	-----	3	17	7	7
1891-----	32.3	+ 8.4	72	—14	2.41	+1.19	4.50	1.21	-----	6	14	9	8
1892-----	18.9	— 5.0	68	—29	1.65	+0.43	3.04	0.20	10.9	8	9	8	14
1893-----	22.0	— 1.9	70	—21	1.31	+0.09	2.80	0.46	7.6	7	10	9	12
1894-----	30.1	+ 6.2	73	—17	0.95	—0.27	1.75	0.25	1.3	3	15	6	10
1895-----	25.4	+ 1.5	63	—16	1.63	+0.41	5.74	0.00	4.1	5	11	9	11
1896-----	30.8	+ 6.9	70	—10	0.65	—0.57	1.79	T.	1.6	4	10	8	13
1897-----	18.0	— 5.9	60	—25	1.65	+0.43	3.22	0.61	15.9	6	11	7	13
1898-----	18.1	— 5.8	60	—25	0.48	—0.74	1.70	T.	3.9	3	15	8	8
1899-----	22.6	— 1.3	75	—19	1.61	+0.39	4.28	0.10	4.3	5	12	9	10
1900-----	26.9	+ 3.0	63	—10	0.45	—0.77	2.70	T.	2.4	4	13	6	12
1901-----	20.5	— 3.4	64	—31	0.93	—0.29	2.75	0.05	5.4	6	10	9	12
1902-----	20.1	— 3.8	59	—20	2.23	+1.01	5.51	0.67	12.9	8	9	6	16
1903-----	19.6	— 4.3	58	—27	0.41	—0.81	1.96	T.	3.7	4	11	9	11
1904-----	23.4	— 0.5	67	—19	1.44	+0.22	3.68	0.06	12.3	5	12	7	12
1905-----	27.0	+ 3.1	62	—11	0.52	—0.70	1.69	T.	4.2	3	19	6	6
1906-----	25.7	+ 1.8	65	— 9	1.43	+0.21	2.81	0.37	1.4	6	11	7	13
1907-----	28.8	+ 4.9	62	— 9	1.00	—0.22	2.28	0.05	4.7	5	10	7	14
1908-----	27.2	+ 3.3	67	—17	0.57	—0.65	2.07	0.05	3.8	3	15	8	8
1909-----	15.1	— 8.8	60	—26	2.18	+0.96	6.10	0.89	13.7	11	10	5	16
1910-----	23.4	— 0.5	57	—14	0.37	—0.85	1.39	0.01	3.0	3	15	7	9
1911-----	27.9	+ 4.0	60	—24	2.57	+1.35	4.43	0.62	12.6	7	13	6	12
1912-----	29.2	+ 5.3	64	—13	0.74	—0.48	1.75	0.10	1.1	3	18	7	6
1913-----	32.0	+ 8.1	65	—13	1.02	—0.20	4.73	0.00	1.3	4	15	5	11
1914-----	15.7	— 8.2	63	—31	1.30	+0.80	2.24	0.57	11.1	9	10	6	15
1915-----	25.0	+ 1.1	56	—10	0.69	—0.53	1.70	T.	4.6	5	11	8	12
1916-----	18.7	— 5.2	67	—25	1.04	—0.18	2.00	0.35	6.7	6	15	8	8
1917-----	14.5	— 9.4	62	—40	0.56	—0.66	1.70	0.14	6.7	6	10	9	12
1918-----	32.7	+ 8.8	68	— 7	1.30	+0.08	3.30	0.37	5.1	8	9	8	14

T. indicates an amount too small to measure, or less than .005 inch precipitation and less than .05 inch snowfall.

MONTHLY STATE DATA FOR 1918.

Month	Barometric Pressure, Inches (Sea level).				Temperature, Degrees, F.			Relative humidity %		Precipitation, Inches.					Number of Days.				Sun- shine.		Wind.			
	Mean.	Highest.	Date.	Lowest.	Date.	Mean.	Departure from normal.	Highest.	Lowest.	Mean. 7 a.m. + 7 p.m. 2	Departure from normal.	Average.	Departure from normal.	Greatest.	Least.	Snowfall.	.01 inch or more precipitation.	Clear.	Partly cloudy.	Cloudy.	Per cent of the pos- sible amount.	Departure from normal.	Average hourly velocity.	Prevailing direction.
January	30.03	30.82	31	29.34	12	8.6	—9.3	53	—35	82	+1	1.02	—0.03	2.79	0.26	11.2	7	13	8	10	53	+3	9.6	NW.
February	30.06	31.07	21	29.02	14	23.0	+2.5	70	—36	78	—1	0.95	—0.20	2.10	0.09	6.0	5	14	7	7	62	+7	9.3	SW.
March	30.03	30.71	15	29.12	9	42.9	+9.6	85	0	63	—10	0.63	—1.14	2.12	T.	2.6	3	19	7	5	73	+16	9.1	SW.
April	30.01	30.78	9	29.23	29	44.8	—3.9	79	12	62	—5	2.32	—0.54	4.20	1.01	3.5	9	12	8	10	60	0	9.6	NE.
May	29.91	30.43	23	29.09	9	64.9	+4.4	98	25	66	+1	6.87	+2.30	11.98	2.72	T.	13	13	11	7	66	+4	10.0	SW.
June	29.93	30.33	7	29.56	1	70.8	+1.7	104	38	69	0	5.29	+0.91	10.19	1.55	0	11	16	10	4	69	+1	7.5	SE.
July	30.02	30.31	12	29.65	3	73.1	—1.0	105	40	66	—1	3.17	—0.79	8.05	0.26	0	8	19	8	4	72	—2	6.3	SW.
August	29.93	30.30	19	29.58	5	76.0	+4.2	113	38	67	—4	3.61	—0.07	8.38	0.54	0	8	16	10	5	68	—3	6.7	SW.
September	30.09	30.51	10	29.70	14	58.6	—4.8	93	20	68	—6	1.87	—1.49	4.62	0.48	0	6	16	8	6	63	0	6.3	NW.
October	30.03	30.44	3	29.17	27	55.1	+4.3	93	21	72	+1	3.64	+1.18	7.56	1.36	0.8	7	13	7	11	52	—9	7.6	S.
November	30.04	30.70	23	29.03	28	39.9	+4.9	76	0	78	+4	2.11	+0.60	5.10	0.70	4.4	7	13	5	12	52	—4	8.9	NW.
December	30.04	30.51	18	29.29	9	32.7	+8.8	68	—7	82	+2	1.30	+0.08	3.30	0.37	5.1	8	9	8	14	33	—10	7.9	NW.
Means and extremes	30.01	31.07	---	29.02	---	49.2	+1.8	113	---	71	—2	32.78	+0.81	11.98	0.09	33.6	92	173	97	95	61	0	8.2	SW.

ANNUAL REPORT OF THE

COMPARATIVE DATA FOR THE STATE—Annual.

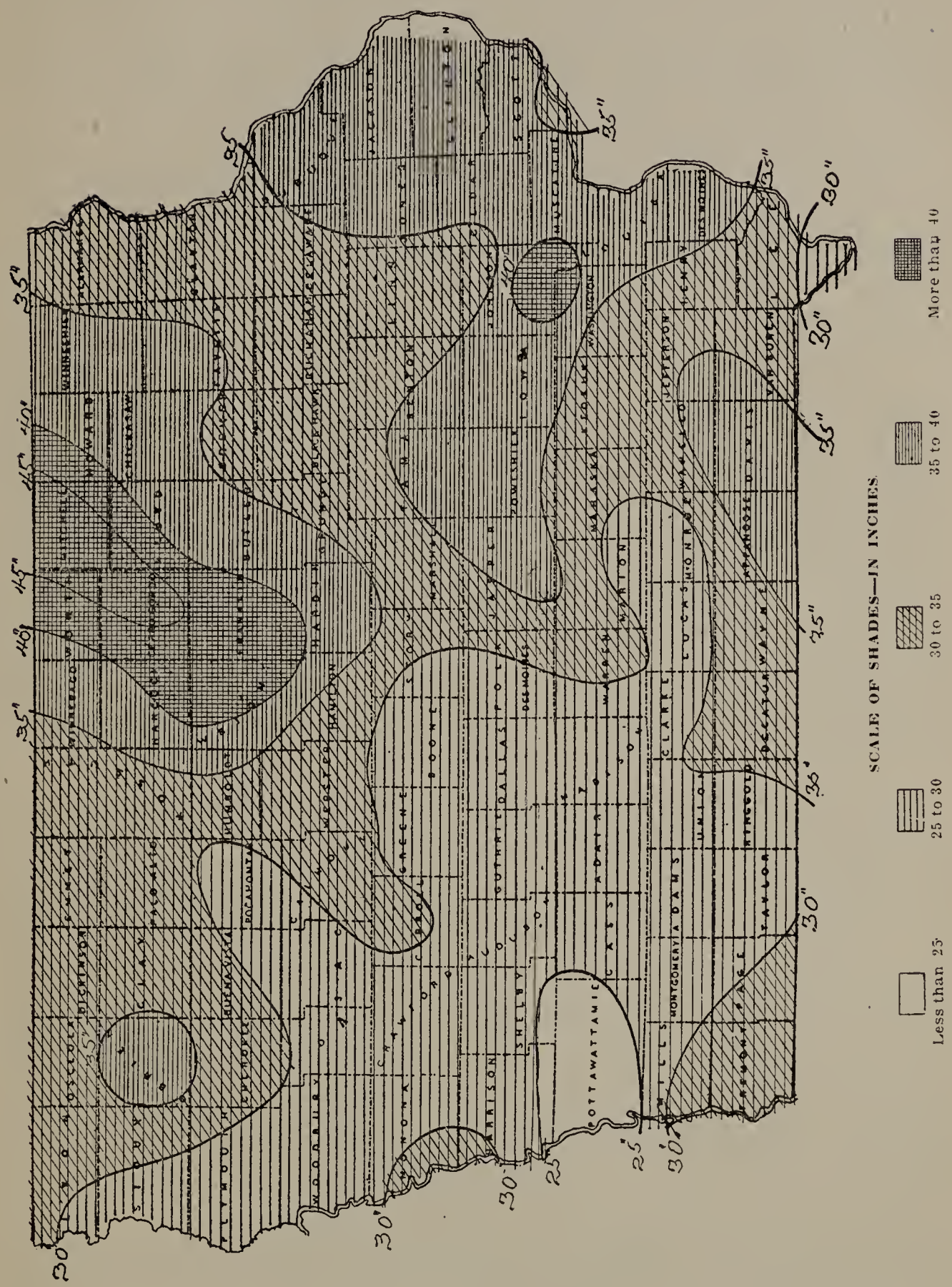
Temperature						Precipitation in Inches.			
Year.	Mean annual.	Highest.	Date.	Lowest.	Date.	Annual.	Greatest annual.	Least annual.	Av. snowfall.
1890..	48.0	110	July 13.....	—27	January 22.....	31.30	45.74	16.00	-----
1891..	47.3	106	August 9.....	—31	February 4.....	32.90	49.05	23.48	-----
1892..	46.6	104	July 11.....	—38	January 19.....	36.58	48.77	24.78	34.2
1893..	45.7	102	July* 13.....	—36	January 14.....	27.59	33.27	19.19	37.2
1894..	49.7	109	July 26.....	—37	January 25.....	21.94	29.81	15.65	19.2
1895..	47.2	104	May 28.....	—33	February 1.....	26.77	35.25	18.57	26.0
1896..	48.6	104	July 3.....	—20	January 4.....	37.23	51.60	28.68	22.6
1897..	47.8	106	July* 23.....	—30	January 25.....	26.98	36.18	20.21	38.8
1898..	47.7	103	August 20.....	—25	December 31....	31.34	55.47	19.51	40.3
1899..	47.3	104	September 6....	—40	February 11....	28.68	42.06	21.79	23.4
1900..	49.3	103	August 3.....	—27	February 15....	35.05	47.33	25.05	25.8
1901..	49.0	113	July 22.....	—31	December 15....	24.41	37.69	16.35	38.5
1902..	47.7	98	July 30.....	—31	January 27.....	43.82	58.80	20.14	28.0
1903..	47.2	101	August 24.....	—27	December 13....	35.39	50.53	26.41	19.4
1904..	46.3	100	July 17.....	—32	January 27.....	28.51	38.93	19.34	29.2
1905..	47.2	104	August 11.....	—41	February* 2....	36.56	52.26	24.66	38.3
1906..	48.4	102	July 21.....	—32	February 10....	31.60	44.34	20.63	32.8
1907..	47.4	102	July 5.....	—31	February 5.....	31.61	43.90	19.93	24.0
1908..	49.5	101	August 3.....	—18	January 29.....	35.26	49.98	24.11	22.7
1909..	47.4	103	August* 15.....	—26	February* 15...	40.01	53.48	27.20	49.0
1910..	48.6	108	July 16.....	—35	January 7.....	19.87	27.99	12.11	23.4
1911..	49.5	111	July* 3.....	—35	January 3.....	31.37	46.77	19.74	35.3
1912..	46.4	104	September 8....	—47	January 12.....	28.89	33.13	15.25	39.5
1913..	49.7	108	July* 16.....	—25	January 8.....	29.95	45.18	20.31	25.4
1914..	49.1	109	July 12.....	—31	December 26....	31.93	44.11	23.30	27.5
1915..	47.8	99	May 14.....	—32	January 28.....	39.53	51.15	27.29	31.3
1916..	47.2	106	August 4.....	—34	January 13.....	28.90	46.34	22.48	29.5
1917..	44.8	106	July 30.....	—40	December 29....	27.81	36.00	20.78	32.4
1918..	49.2	113	August 4.....	—36	February 4.....	32.78	47.53	25.03	33.4

*And other dates.

STATIONS.		Killing Frosts.		STATIONS.		Killing Frosts.		STATIONS.		Killing Frosts.	
		Last in Spring.	First in Autumn.			Last in Spring.	First in Autumn.			Last in Spring.	First in Autumn.
Northern Division—				Central Division—				Southern Division—			
Algona	18	May	Sept.	Ames	13	May	Sept.	Afton	21	Apr.	Sept.
Allison	20	May	Sept.	Audubon	11	May	Sept.	Albia	22	Apr.	Sept.
Alta	20	May	Sept.	Baxter	30	Apr.	Sept.	Allerton	30	Apr.	Sept.
Alton	18	Apr.	Sept.	Belle Plaine	13	May	Sept.	Atlantic	1	May	Sept.
Belmond	20	May	Sept.	Boone	26	Apr.	Sept.	Bedford	1	May	Sept.
Britt	20	May	Sept.	Carroll	13	May	Sept.	Bloomfield	21	Apr.	Sept.
Charles City	21	May	Sept.	Cedar Rapids	21	May	Sept.	Bonaparte	21	Apr.	Sept.
Deeora	21	May	Sept.	Clinton	1	May	Oct.	Burlington	21	Apr.	Nov.
Elkader	21	May	Sept.	Davenport	19	Apr.	Oct.	Centerville	21	Apr.	Sept.
Estherville	18	May	Sept.	Delaware	13	May	Oct.	Chariton	1	May	Sept.
Fayette	20	May	Sept.	Denison	13	May	Sept.	Clarinda	1	May	Sept.
Forest City	20	May	Sept.	Des Moines	20	Apr.	Sept.	Columbus Junction	1	May	Oct.
Humboldt	20	May	Sept.	Dubuque	25	Apr.	Oct.	Corning	1	May	Sept.
Inwood	18	May	Sept.	Fort Dodge	25	Apr.	Sept.	Corydon	1	May	Sept.
Lake Park	18	May	Sept.	Grinnell	1	May	Sept.	Creston	1	May	Sept.
LeMars	18	Apr.	Sept.	Grundy Center	1	May	Sept.	Cumberland	1	May	Sept.
Mason City	20	May	Sept.	Guthrie Center	13	May	Sept.	Earlham	1	May	Sept.
New Hampton	21	May	Sept.	Harlan	13	May	Sept.	Fairfield	1	May	Sept.
Nora Springs	21	May	Sept.	Independence	13	May	Sept.	Ft. Madison	25	Apr.	Sept.
Northwood	21	May	Sept.	Iowa City	2	May	Sept.	Glenwood	30	Apr.	Sept.
Pocahontas	20	May	Sept.	Iowa Falls	14	May	Sept.	Greenfield	13	Apr.	Sept.
Postville	21	May	Sept.	Jefferson	30	Apr.	Sept.	Indianola	10	Apr.	Sept.
Rock Rapids	18	Apr.	Sept.	Little Sioux	25	Apr.	Sept.	Keokuk	1	Apr.	Nov.
Sanborn	18	May	Sept.	Logan	1	May	Sept.	Keosauqua	1	May	Sept.
Sibley	16	May	Sept.	Maquoketa	1	May	Sept.	Knoxville	23	Apr.	Sept.
Sioux Center	18	May	Sept.	Marshalltown	1	May	Sept.	Lamoni	28	Apr.	Sept.
Storm Lake	16	Apr.	Sept.	Monroe	1	May	Oct.	Lenox	21	Apr.	Sept.
Washta	21	May	Sept.	Olin	1	May	Sept.	Mt. Air	1	May	Oct.
Waverly	18	May	Sept.	Onawa	1	May	Sept.	Mt. Pleasant	21	Apr.	Sept.
West Bend	18	May	Sept.	Perry	30	Apr.	Sept.	Murray	21	Apr.	Sept.
				Rockwell City	26	Apr.	Sept.	Northboro	21	Apr.	Sept.
				Sac City	10	Apr.	Sept.	Oskaloosa	21	May	Sept.
				Sioux City	1	May	Sept.	Ottumwa	21	Apr.	Sept.
				Tipton	13	May	Oct.	Pella	1	May	Sept.
				Toledo	3	May	Sept.	St. Charles	21	Apr.	Sept.
				Waterloo	1	May	Sept.	Shenandoah	1	May	Sept.
				Wauke	13	May	Sept.	Sigourney	1	May	Sept.
				Webster City	1	May	Sept.	Stockport	1	May	Sept.
				Williamsburg	1	May	Sept.	Thurman	1	May	Sept.
								Washington	25	Apr.	Sept.
								Winterset	9	Apr.	Oct.
								Omaha, Nebr.	28	Apr.	Oct.

+Date of last temperature of 32 or lower in the spring, or first temperature of 32 or lower in the autumn (as the case may be) when frost was not reported.

TOTAL PRECIPITATION, YEAR 1918.



CLIMATE AND CROP REVIEW.

The winter of 1917-18 was one of the coldest, averaging 5.4° below normal and only 0.5° warmer than 1892-93, the coldest of record. Snowfall averaged 3.4 inches more than the normal and because of the continuous cold weather and the absence of sleet and rain the snow covering was generally porous and continuous, except in some west and southwest counties. Winter wheat, except where seeded in corn fields, was generally blown bare of snow.

March was abnormally warm with deficient precipitation, except in the northern tier of counties. Frost left the ground early in the month; the soil worked up in fine condition; seeding of spring wheat and oats was completed in the south and made rapid progress in the north portions; and husking of the 1917 corn crop which had been delayed by the soft condition of the corn and by the severity of the winter, was about finished. Winter wheat came through the winter in good condition, especially in the southeast counties. Some that had apparently not germinated in the fall of 1917, germinated in March, and though there was considerable difference of opinion among the farmers and others as to whether this would make a crop, it is known that in many instances it did make a crop of 15 to 25 bushels per acre. The drouth of March continued till the middle of April, except scattered showers or snows during the first week. The drouth, high winds and low humidity killed some of the winter wheat and much of the young clover, timothy and alfalfa. On March 18, a number of stations reported the lowest relative humidity ever recorded. At Des Moines it was 5 per cent at 2 and 3 p. m. A large acreage of winter wheat, hay and pasture land was plowed up. Considerable early spring wheat was drilled in with the winter wheat where the stand was thin and patchy.

Iowa's hay and pasture land was decreased by about three quarters of a million acres, the acreage of other crops, mainly corn, spring wheat and barley, being correspondingly increased. The acreage of spring wheat would have been much larger if sufficient cars had been available to transport the seed. The dry weather of the early spring and the cold weather of April made germination of spring grains very irregular. They depended largely upon subsoil moisture till the middle of April. Warmer weather with copious showers toward the close of April improved grains; some that had been seeded six weeks previously had just begun to show green at the end of the month. A heavy snowstorm extended across the State from southwest to northeast on April 19th-21st. In Taylor County this snow accumulated to the unusual depth of 2 feet or more, exceeding the total fall of the winter months preceding.

Favorable weather offset the unfavorable labor conditions. Spring work progressed rapidly. Eighty-five per cent of the corn ground was ready for the planter and a little planting had been done by the close of April. Seed corn was scarce and of very low vitality due to the lateness of the crop and the damaging frosts in 1917. Unprecedented efforts of county agents and farmers in seed testing, and cautious delay in planting most of the acreage after the ground was warm and the weather fit, resulted in a good stand of corn.

Violent temperature fluctuations, from freezing to 95°, May 1st to 4th, with high southwest winds and low humidities, did further damage to winter wheat and grasses. Tornadoes May 9th and 21st covered considerable areas but did little damage to crops. Soil and weather conditions in May were very favorable for germination and growth of corn.

Heavy rains the first week in June caused considerable damage to corn by erosion and overflow, from Webster and Hamilton Counties southeast to Poweshiek and Johnson Counties. Replanting from this cause was probably not greater than usual for the State as a whole, but because of the large acreage of spring plowed sod, the cut worm damage and consequent replanting from this cause was unusual. This replanted corn was about all that was caught by the early frosts, September 18-21. The soft corn which is 4 per cent of the crop, is a fairly good indication of the extent of this replanting. Seventeen counties, mostly in the southwest, reported no appreciable amount of soft corn, while the northeast counties reported considerable.

Reports from many hundred crop correspondents on July 1, showed the average condition of corn to be 105 per cent, which has been exceeded but once in 29 years. A hot period about the middle of June with record high temperatures on the 16th was believed to have prematurely ripened oats in the southwestern one-fourth of the State. Such a period is not considered good for any small grain, yet all small grains finally shows yields above normal. Smut affected spring wheat seriously.

Harvest came on about a week earlier than normal and continued through July under conditions unusually favorable for labor and curing shocked grain, except in the northeast and north-central counties where heavy rains caused delay and damaged the shocked grain.

During July a marked deficiency in rainfall began to be felt over the south-central and southwest counties, causing the pastures to fail and upland corn to begin firing. The average condition of corn on August 1 was 101 per cent. In the next eight days, record breaking high temperatures with drouth, damaged corn throughout the southwest one-third of the State, amounting to a disaster in some of the southwest counties. In Adams County where the heat and drouth were greatest, the average yield of corn is only 7 bushels per acre, approaching the record low yield of 5 bushels per acre in Page county in the historic drouth of 1894. Roughly it may be said that Iowa's corn crop was damaged \$5,000,000 per day during this eight-day period. Though it is difficult to assign a damage value to particular days, it seems probable that the damage on three days August 4-6, at the climax, was approximately \$10,000,000 per day. To save the crop, much of it was cut for fodder and silage. Live stock was put on winter feed in the damaged area as early as the latter days of July and many hogs and cattle were shipped to regions where feed was more plentiful. In the northern and eastern portions, the corn crop was bountiful, the largest average yield being 51 bushels per acre in Cedar County.

Profiting from the anxiety and tremendous effort in obtaining good seed corn last spring, farmers have this fall saved a large supply, in most instances enough for two years, and it is believed that the quality is

excellent, though no extensive tests have yet been made and much will depend on the care used in storing this seed.

Sweet corn yielded well, outside of the drouthy section, but suffered unusual damage from the corn ear worm, *Heliothus obsoleta*, for which, as yet, entomologists have discovered no remedy within the bounds of economy.

A determined campaign to increase the acreage seeded to winter wheat this fall has brought about large results in the sections of the State where the crop is usually grown, but not much extension to new territory. It is impossible at this time to state what the acreage is, but it is probably somewhat less than the million-acre goal set. The crop is entering the winter in unusually good condition, 95 per cent of the acreage having made good to rank growth and become well established. Four per cent has germinated but made little showing above ground, and only one per cent has apparently not germinated.

With all of its vicissitudes the crop season of 1918 finally resulted in the usual large cash balance for the State.

Bulletin No. 1, April 9, 1918—

The first half of the past winter was severely and continuously cold, with a good snow covering. March and the latter part of February were mild. Frost was out of the ground early in March, not having penetrated as deeply as usual during the winter. At the close of March the season was about two weeks earlier than normal; farm work was well advanced; soil in fine condition; seeding of spring wheat and oats completed in the south and progressing rapidly in the north. Most of the 1917 corn crop remaining unhusked in the fields was husked during March though a little was left to be done in the early days of April. Wheat wintered well, especially in the southeast, where moisture was abundant. Some wheat that failed to germinate last fall, germinated in March. During the past two weeks winter wheat has suffered from drouth in all but the southeast section where the rainfall has generally exceeded one inch. In considerable areas over the southwestern and west-central portions, the rainfall has been very deficient and winter wheat has been plowed up or cross drilled with early spring wheat. In Adams and Jasper counties the water supply is failing.

A remarkably large acreage of spring wheat has been seeded. In many counties nearly every farm has a small piece of wheat seeded through patriotic motives and regarded as experimental in those sections where it has not been hitherto raised. A much larger acreage would have been devoted to wheat if cars had been available to ship in the seed. Oats seeding is nearing completion in the north, about the usual area having been seeded. Barley seeding is well under way.

Meadows and pastures generally wintered well, but are badly needing rain.

Dry soil has retarded or prevented germination of small grain in all but the southeast portion. Good rains occurred in nearly all sections Friday night and Saturday. More than the usual amount of gardening and potato planting has been done.

Plowing for corn is well advanced. Seed corn testing and seed distribution have been proceeding rapidly during the last few weeks.

Live stock is in good condition, except in some sections where roughage has been short. The mild, dry weather has been especially favorable for the pig and lamb crop.

Bulletin No. 2, April 16, 1918—

Cold, dry, sunshiny weather prevailed the fore part of the week with freezing temperatures or frosts in all portions of the state each night till

the night of the 13th-14th. Several stations reported temperatures below 20, the lowest being 14 at Audubon. The average daily deficiency in temperature for the State was about 2 degrees. Ice one-half inch thick was reported on the 8th, 9th and 10th.

The cold weather was due to an area of high barometric pressure that persisted over the Great Lakes. The outflowing winds from this were as usual east to northeast over Iowa. Generally such winds are accompanied by considerable cloudiness, but in this instance sunshine prevailed.

The temperature began to moderate Sunday, the 14th, due to the approach of a large general storm that formed in Nevada Saturday. Showers were quite general over the state Monday and Monday night.

Spring seeded grains have not in general germinated except where sufficient moisture came up from the subsoil; germination is, therefore, uneven. Where sufficient moisture is present spring wheat and pastures are beginning to look green. In some of the northern tier of counties, the moisture in the soil derived from the heavy snows of March has brought pastures along sufficiently for grazing. Winter wheat with all other vegetation has been nearly at a standstill, the rain of the 6th serving only to keep it alive. Barley seeding is well advanced in the central portion and progressing rapidly in the north. A largely increased acreage of onions is being seeded, particularly in the northeastern and Mississippi river counties. Corn acreage will be reduced in some counties through scarcity of reliable seed, small grains, mostly wheat, having taken its place.

The dry weather has been specially favorable for manure hauling, plowing, disking and harrowing for corn; also for soft corn in cribs. Farm labor and horse power have been utilized to good advantage during the favorable weather and are ample so far in most sections.

Bulletin No. 3, April 23, 1918—

The week opened warm but soon became abnormally cold, the average daily deficiency in temperature being about 6 degrees. Copious precipitation occurred in the southern tier of counties except Lee, and northward over the Central District. Rains of agricultural importance occurred in nearly all other sections of the state except some of the northwestern and west-central counties where more moisture is badly needed, particularly in Buena Vista and Woodbury counties. A striking feature was the snowstorm of the 19th-21st, which covered the southern and eastern portions of the state, amounting to 20 inches in Decatur and Ringgold counties, and 6 inches in the central portion of the state. Such a storm is unprecedented so late in the season, though a snowstorm of only slightly less intensity occurred in south central Iowa on April 7, 1917. In Adams, Union, Wayne and Jasper counties a drouth of several months was effectually broken.

The warmth and moisture of the early part of the week germinated most of the oats, the remaining ungerminated wheat in the north, and some of the barley. The freezing and snow are not believed to have caused any damage other than a delay of several days.

Pears and plums are in full bloom in the southern counties. Plowing for corn is well advanced and a few warm days would start the planters in the southern counties. Unless unusually favorable conditions of warmth, sunshine and moisture follow soon the hay crop will be short. The seriousness of the seed corn situation has become more apparent in some of the counties where testing has been thorough.

Bulletin No. 4, April 30, 1918—

Cold and generally cloudy weather prevailed during the past week, the average daily deficiency in temperature being about 8 degrees. Freezing temperature occurred in all but the southern counties and the highest temperatures were generally about 65 degrees. The rainfall was well distributed and generally sufficient, though about two-thirds of the normal. The heaviest rains were in the northern and northwestern portions of the State where the need was greatest.

All vegetation has been nearly at a standstill. Oats and wheat seeded more than a month ago are scarcely beginning to show green over much of the State and some of the later seeding is just sprouting. Though the season was considered two weeks early at the beginning of April, it is scarcely up to normal at the close. However, small grain that has germinated has rooted well, winter wheat has begun to stool in the southeastern countise, and normally warm and moist weather would bring these crops along vigorously.

Few rainy days and cool weather have favored field work which has progressed more rapidly than in any spring in recent years. The labor supply, which is known to be much shorter than usual, has been used to remarkably good advantage. About 85 per cent of the corn ground is ready for planting and only warm, sunny days are needed to start the planters briskly. In fact, a little planting has been done in the southern counties and a few scattered reports of planting have been received from as far north as Greene and Pocahontas counties. However, the scarcity and low vitality of seed corn will keep cautious farmers from taking the risk of planting till the ground is warm.

Pastures and hay lands have suffered seriously from the cold, dry spring.

Fruit trees are in full bloom in the south and beginning to bloom in the central portions of the state.

Bulletin No. 5, May 7, 1918—

Freezing temperatures prevailed on May 1st, ice one-eighth inch thick being reported in the southeastern counties. This was followed by a decided change to warmer with maximum temperatures above 90 degrees in the northern half of the state on the 3d and generally on the 4th, the highest reported being 95 at Forest City on the 3d. The change was like going from the 20th of April to the middle of July in four days.

The warmth caused a marked improvement in all vegetation except where too dry. Strong southwest winds and low humidity caused considerable injury to pastures and meadows in many sections. In Jackson and Madison counties winter wheat has been killed by the drouth and will be plowed up and planted to corn. Good rains fell Monday, the 6th, in south and east portions of the state.

Oats, spring wheat, rye and barley show general improvement, the fields being green and plants about three inches high.

Corn planting is progressing rapidly in the south and beginning in the north with soil in excellent condition generally.

Gardens are badly needing rain; potatoes planted six weeks ago are just beginning to come up in the central portion of the state.

Apples, plums and cherries are in full bloom in the central and southern portions of the state and beginning to bloom in the north. The fruit prospect is considered good. No material damage seems to have resulted from the freezing on May 1st.

Bulletin No. 6, May 14, 1918—

Heavy rains occurred in the northeastern part of the state, but as the soil was dry and receptive, it absorbed most of the rain. Over much of the central and southwestern districts the deficiency in rainfall has become serious. Temperatures in the nineties prevailed in the north and west portions on the 8th and 9th followed by cooler with frost and ice in many sections on the morning of the 13th and snow and sleet in the central district. The temperature averaged about normal. Shifting gales on the 9th caused minor damage to buildings and trees and serious drying effects in the southwest portion. Tornadoes in the late afternoon of the 9th caused serious damage, several deaths and many injuries in Bremer, Chickasaw, Winneshiek, Hamilton and Scott counties. The property loss will total nearly \$1,000,000. The damage to crops was small. Hail was reported in many northern and eastern counties but the damage is not believed to have been great.

Corn planting is 75 per cent completed in the southern counties where the early planting is up, showing a good stand and cultivation has begun in a few localities. In some of the northeastern and north-central counties planting is just beginning, while in the northwest it is well advanced. Small grain, pastures and meadows are doing well in all but the central and southwest districts where rain is badly needed. Much winter wheat is being plowed up in Taylor county. The first crop of alfalfa and probably all hay will be short in these districts.

Bulletin No. 7, May 21, 1918—

Rain was abundant in the north and east portions of the state but very deficient in the southwest. Temperatures were high, averaging about 7 degrees above normal. Frosts on the mornings of the 13th and 14th damaged fruit in some northern counties and nipped the early potatoes. Sunshine averaged nearly 20 per cent above normal. Hail in many sections on the 19th did but little damage. High, drying, southerly winds on the 15th and 16th damaged pastures and meadows in the western half of the state, which was generally dry upon that date. Oats were also damaged on the sandy, north-central uplands where sand or dust storms occurred. In some localities in the southwest, cattle have been taken from the brown, bare pastures and are being fed expensive hay. The hay crop will be short in all but the eastern counties and almost an entire failure in the southwest.

Small grains have made excellent progress in the east and north and are in fair condition in the southwest, except winter wheat.

Corn planting is nearly finished in the south and two-thirds done in the north. Considerable replanting has been necessary, due to poor seed and the ravages of cut and wire worms, particularly on sod. In general, ideal soil and weather conditions, combined with the skill of the Iowa farmer, have made the best of the weak seed corn and a good crop is now in prospect.

Telegraphic reports Tuesday morning show good rains in the southwest portion of the state, but these will be too late to save the hay crop.

Bulletin No. 8, May 28, 1918—

Copious to excessive rains occurred in all but the extreme northeast counties. No section is lacking moisture. Most of this has been soaked up and retained by the soil as shown by the tile drains which are not running full. In some of the central and southeast counties the excesses eroded the hillsides and flooded the lowlands. In Jasper and Poweshiek counties between five and six inches of rain fell and considerable live stock, mostly sheep, were drowned. The area damaged is comparatively small.

On Tuesday afternoon, May 21st, a series of tornadoes occurred in Crawford, Carroll, Greene, Boone, Webster and Hardin counties, causing much damage to property, many injuries and several deaths. Hail damaged crops slightly in many sections and seriously in some southwestern counties.

Temperatures were about normal in the north and west and about 4 degrees above normal in the southeast. Sunshine was slightly deficient.

The drouth is broken in the west and southwest counties, but too late for the hay crop; pastures are improving rapidly. Small grains are all making good progress and becoming too rank in some of the southeastern counties. Winter wheat is heading in the southeast and shooting in the central counties. Cutworm damage to corn, particularly on sod, is unusually prevalent in all sections and will necessitate much replanting; otherwise the stand is remarkably good as a result of diligent seed testing, and unusually favorable soil and weather conditions. Cultivation and late planting have been delayed by rain; weeds are getting a good start in some sections.

Strawberries promise a good crop and are beginning to ripen in the southeast.

Bulletin No. 9, June 4, 1918—

Ideal growing weather prevailed. The rainfall averaged about an inch from Linn county northward and eastward, while in the upper Des Moines watershed and in some counties in the west central and south central districts it averaged more than 4 inches. In some sections rain fell practically every day. Temperatures averaged about 4 degrees above normal. Sunshine was deficient in the northern districts, but averaged about normal. The season is about 10 days earlier than at this time last year.

Crops in general are in unusually good condition, though cultivation of corn has been delayed by wet weather. Field work was possible on but one or two days and in some sections not at all; so the weeds are getting a good start. Replanting fields taken by cutworms and washed out or drowned out by heavy rains has also been delayed. A small percentage of first planting remains to be done. A few days of dry, warm weather will permit cultivation and put this crop in excellent condition. It is reported to be a foot high in Scott county.

Spring wheat, oats and rye are beginning to head at normal height in the southern districts. Hay and pastures show marked improvement, but the rains came too late to make a full hay crop in the central and southwestern districts. Clover is in full bloom in the southwest, but short. The first cutting of alfalfa has begun and home-grown strawberries are on the market in the southern districts.

Bulletin No. 10, June 11, 1918—

Excessive rains towards the close of last week and continuing in some sections till the 6th, caused much damage by overflow and erosion, particularly in central tiers of counties, extending from the Missouri nearly to the Mississippi; also in some of the south central counties. In the Skunk, Iowa and Cedar valleys, many bridges were washed out, the damage running into the hundreds of thousands of dollars. The Des Moines and Raccoon also overflowed to some extent. The crop damage in about fifteen central counties is estimated at about 5 per cent. Toward the close of the week, the weather became more favorable, cultivation of corn was pushed rapidly on the uplands, and preparations were made on the lowlands for replanting to corn or seeding to millet and buckwheat. Hail is reported from many localities, but the total area damaged is relatively small.

The abundant moisture, followed by warmth and sunshine, caused all vegetation to make excellent growth. A few more days of warm, dry weather will permit the weeds to be cleared from the corn. Corn prospects are generally very good and far ahead of this time last year; oats in some cases are too rank; winter wheat, rye and oats are heading in all sections of the state, and spring wheat north to the central districts; winter wheat shows improvement in the southwest. The first crop of alfalfa is being cut in the southern and west central districts and clover in the south. Strawberries are all gone in the southwest and being picked rapidly in the central districts, the crop being generally good.

Bulletin No. 11, June 18, 1918—

Hot, dry, sunshiny weather prevailed. A wide belt extending from the northwestern to the southeastern portions of the state had scarcely a trace of rain. The southwest one-fourth of the state had the most rain and there it was generally less than one-half inch. Temperatures averaged about 7 degrees above normal and sunshine about 25 per cent above normal.

Most all crops, particularly corn, made wonderful progress. Early corn is knee high in the north and will be ready to lay by at the close of the week in some south central counties. The hot, dry weather has been excellent for weed killing, which has progressed rapidly, and fields are now mostly clean, having been cultivated generally twice and in the south three times. The crop is about a week ahead of the average and two or three weeks ahead of last year. Small grains are heading well in most sections, though short. The hot weather has checked the tendency to rankness in

some sections. Wheat rust is reported in the southwestern counties. Harvest will be about a week earlier than normal. Winter wheat harvest will begin in a day or two in the extreme southeast counties, in the central counties by the 24th, and in the northeast by July 1st. Spring wheat harvest will begin in the southern counties about July 3d and in the north about July 20th. Oats, south, July 1st; north, July 15th. Rye, south, June 23d; north, July 5th. Barley, south, July 1st; north, July 15th.

First crop alfalfa has been harvested in unusually fine condition; yield fair to good. Clover cutting in progress; yield good in southeast; poor in west.

Potatoes have made a good growth, but the heat has caused tip burn in some sections and rain would be highly beneficial. The crop has been laid by in some southern counties.

Strawberries passed rapidly with poor to good yield; raspberries are very promising; cherries will be a fair crop.

Bulletin No. 12, June 25, 1918—

Cooler weather with less than normal sunshine checked the premature ripening of small grain and permitted the heads to fill nicely in nearly all sections. Winter wheat harvest has begun in the southern tier of counties, and will extend over all but the northern one-third of the state during the coming week. Rust has damaged this crop somewhat in the west-central and southwest counties. Spring wheat harvest will begin in the extreme southwest July 1st and reach the central counties about July 9th. Estimated harvest dates of other crops remain about the same as last week.

Infrequent showers were favorable for cultivation of corn which proceeded rapidly in all but a few counties in the north-central district, the fields now being generally clean. The prospects for this crop are now excellent except relatively small replanted areas which are just coming up in some localities.

In the north-central sugar beet district, the fields of this crop are generally weedy.

Gardens, potatoes and pastures have suffered from drouth and heat in some localities in the western half of the state, but good rains Monday will relieve these conditions somewhat. Home-raised new potatoes are being used considerably in the southern half of the state.

The cherry crop is generally disappointing. Raspberries are beginning to ripen and the prospects are generally good.

Bulletin No. 13, July 2, 1918—

In general crop prospects are unusually good. Cool weather prevailed with temperatures averaging about 3 degrees below normal. Rains were ample and well distributed, except the southwest district where there is a marked deficiency. Corn cultivation and haying were delayed by frequent rains in the eastern half of the state. Corn is being laid by in nearly all sections with the crop in excellent condition. Considerable clover hay was spoiled in curing. The crop is heavy in the eastern and light in the western counties.

The cool, cloudy, moist weather has been favorable for small grains which are filling well and promise large yields, except early oats which in some places are heading short and were prematurely ripened by the hot weather about three weeks ago. Harvest has been beneficially delayed to later dates than at first estimated. Winter wheat harvest has advanced slowly northward during the week to the third tier of counties, will become general in the middle of the state by the 9th, and will reach the north line about the 15th. Oats harvest now extends from Fremont to Henry counties and will reach the northern part of the state about the 12th-15th. Spring wheat harvest is beginning in the extreme south this week and will reach the middle of the state about the 16th. Rye harvest is completed in the south, is beginning in the middle and will reach the north about the 10th. Barley harvest is beginning in the south, will extend from Taylor to Jackson counties by the 9th and reach the north by the 16th.

A severe hailstorm June 27th, damaged crops about 60 per cent in about eight townships in southeastern Polk, northern Marion and southern Jasper counties. Damaging hail occurred in several other counties on this date.

Grasshoppers are damaging all crops, particularly pastures in the southwestern counties. Some pastures are brown and bare and stock is being fed.

Bulletin No. 14, July 9, 1918—

The week opened hot with temperatures above 90, but turned cool and cloudy. The deficiency in temperature averaged about 2 degrees. Frequent and heavy rains in the northern and eastern portions of the State delayed harvesting and haying and caused oats to lodge badly in some sections. Scab and rust attacked spring wheat in some counties. Drouth and grasshoppers continue to damage all crops in the southwest and west central counties. Corn is far advanced, being mostly laid by and beginning to tassel in all sections. Harvest is in full progress in the central portion of the state and beginning in the north. Threshing has begun in Fremont county. Indications are that the yield of spring wheat, winter wheat and barley will be good; that of oats, fair, but considerably below last year.

Bulletin No. 15, July 16, 1918—

Cool, dry weather prevailed till near the close of the week, when good rains occurred in the northern and light showers in the southern portions of the state. Temperatures averaged about 6 degrees below normal in the eastern and about 1 degree below in the western portions. Sunshine was much above normal, except the extreme western and northern counties. The drouth in the southwestern part of the state is becoming serious.

Conditions were ideal for using labor and horse power to the best possible advantage in haying and harvesting. Though put to a supreme test, farmers have been able to cope with the difficult labor situation. In some cases business men have gone out from the towns to help in the late afternoon and evening. Winter wheat and early oats harvest is completed in the southern districts and beginning along the north line. Uneven germination due to lack of moisture last fall has caused winter wheat to ripen unevenly. Spring wheat harvest is in full progress in the central and western districts and will begin in the north central and northeast districts about the 23d-25th. Rye harvest is completed except in the north central district. Barley harvest is completed in the southern and central districts and is in full progress in the northern districts. Oats threshing began in Van Buren county on the 12th, yielding 48 bushels per acre; and in Pottawattamie county on the 13th, yielding 41 bushels. In Davis county winter wheat yielded 31 bushels. Second crop alfalfa is ready to cut. Much other hay of excellent quality has been harvested.

Corn made good progress except in the southwest district, is tasseling rapidly in most sections, and silking in some. Unless a good soaking rain comes soon the crop will be seriously damaged in the southwest district where the leaves rolled badly during the past week with comparatively moderate temperatures.

Pastures are generally short in the southwestern third of the state and are brown and bare in the extreme southwest counties, where on many farms stock has been fed for the past three weeks and much live stock is being sold to avoid using expensive feed.

Bulletin No. 16, July 23, 1918—

Ideal weather for harvesting, haying, threshing and most crops, prevailed in nearly all parts of the state. The week opened cool and cloudy, but became sunny and hot with maximum temperatures above 90 Friday to Monday afternoons. The highest reported was 100 at Boone and Clarinda. Temperatures averaged slightly above normal. Infrequent rains have favored harvesting and haying, yet the moisture has been generally sufficient. The drouth in the extreme southwest counties was broken by good rains on the 17th. More rain is badly needed in Cass and Adams counties and eastward over Warren and Lucas counties, where corn rolled considerably toward the close of the week. Corn is generally in good condition, tasseling and silking in the central and north and earing well in the south. Grasshoppers have injured corn and late oats in Sac county and southward to Adams county; and farmers are combating them with dozers and poison.

Harvest is finished in the south except some late fields, and threshing is in full progress. Yields are generally good and quality excellent. In Scott county one field of wheat yielded 55 bushels per acre. While oats yields are good, no phenomenally heavy yields like last year have been reported. Scab has seriously affected spring wheat in many sections and "barley stripe" is common. Very little black stem rust is reported.

The hot weather at intervals through the season has reduced the early potato crop to considerably below normal; blight is prevalent. Gardens are needing rain. Homegrown tomatoes are on the market in the central portion of the state.

Bulletin No. 17, July 30, 1918—

Hot weather prevailed with maximum temperatures above 90 degrees nearly every day. The highest reported was 105 degrees at Clarinda on the 28th. Temperatures averaged about 5 degrees above normal. Rainfall was heavy to excessive in the northern districts and very deficient in the central, south central and southwest districts. High winds and hail occurred in some northern counties.

The rains delayed harvesting in the north and together with the high wind caused oats to lodge so that many fields can be cut only one way. Considerable of the late oats and spring wheat remains to be cut in the northeastern district, where in places the fields are too wet for the binders. The yield of spring wheat in Blackhawk county has been reduced 50 per cent by rust. Threshing is progressing in all but the northeast district. Yields are generally good.

Corn has made good progress except in the southwest one-fourth of the state, where extreme heat and serious drouth have caused it to fire on thin uplands. In other sections corn is earing well and promises an unusually large crop. Strong winds blew the corn down badly in the northern districts, but it is generally straightening up. In general the crop is two or three weeks ahead of last year. Early sweet corn is being used in the north.

Pastures have failed in the southwest and live stock has been put on winter feed. Potatoes and garden truck in this section have been damaged by drouth. Home grown tomatoes are on the market in nearly all sections.

Bulletin No. 18, August 6, 1918—

Abnormally cool weather with a minimum temperature of 46 in Delaware county on July 31st was followed by intense heat in the south half of the state. At Pella the temperature range was 65 degrees, from 47 on July 31st to 112 on August 4th. The highest temperature was reported as 113 at Clarinda on the 4th, equaling the highest ever recorded in the state. In the southwest one-fourth of the state, high temperature records of 40 to 46 years were broken. Rainfall of agricultural importance was confined to about 15 counties in the northeastern part of the state. The southwest part, which has been deficient in rainfall for several weeks, suffered seriously from three days of intense heat and the strong southerly winds of Monday, August 5th. Corn has been injured 50 per cent or more in many southwest counties, and, unless rain comes soon, it will be nearly a total loss. In the northern and eastern portions, prospects for corn were never better. The crop has advanced rapidly, roasting ears are reported in all sections and the earliest has begun to dent.

Threshing is 50 to 75 per cent completed in the southern half of the state and in full progress in the north. Yields are generally good to excellent and quality good. Wheat is being hauled to market direct from the machines. Blight and aphid are seriously affecting late potatoes which will not yield as well as has been indicated. Garden truck is suffering for rain except in the northeast district and is practically a failure in the southwest.

Pasture and new seedings of clover and other grasses have failed generally in the south and west. Plowing, in preparation for a large acreage of winter wheat, has begun in many sections.

Bulletin No. 19, August 13, 1918—

Hot weather continued in nearly all parts of the state except on the 8th and 9th when cooler weather prevailed. The mean temperature averaged about 8 degrees above normal. Most stations had temperatures of 100 or higher on one or more

days. Good rains occurred in the northwest portion early in the week, but drouth continued in the south half of the state till somewhat relieved by rains Saturday evening and Sunday; more rain is badly needed. Hot winds again prevailed on Monday, the 12th. The zone of damage to corn spread northward and has a rather sharply defined northern boundary extending through the northern portions of the counties from Harrison on the west to Scott on the east. The damage south of this line approximates 25,000,000 bushels valued at \$40,000,000 and will increase daily as long as the hot winds and drouth continue. Many fields look as though they had suffered from a killing frost. Efforts are being made to save the remnant of the crop by cutting and shocking, filling silos or turning in livestock. In the north half of the state prospects are excellent.

Pastures, gardens, potatoes and new seedings of timothy and clover are a failure in the drouth-stricken area and stock water has failed in many places.

Shock threshing and stacking progressed rapidly except in the north-central and northwest districts where delayed by heavy rains early in the week, which caused molding in the shock where the grain was weedy. Fall plowing is progressing where there is sufficient moisture.

Bulletin No. 20, August 20, 1918—

Rain occurred in all portions of the state, but amounted to less than an inch in the extreme western and south central counties, and in Sac, Calhoun, Humboldt, Webster, Boone and Blackhawk counties. Heavy local rains occurred Friday and Saturday, and in the northeastern one-fourth of the state the rains were excessive and damaging in many places. The largest weekly amount was 6.31 inches at Nora Springs. Temperatures were near 100 degrees in all sections Tuesday afternoon and in the south half on Friday, though on the latter day the maximum varied from 71 at Decorah in the northeast to 102 at Clarinda in the southwest.

Wet weather delayed threshing. Shocked grain was damaged in the northeast. Only a small percentage of threshing remains to be done in the south half of the state. Reports of yields continue good, particularly in the north.

Corn made good progress where not injured beyond recovery by the heat and drouth of the preceding two weeks. The rains are helping it to fill; the earliest is denting; and the crop is practically assured. In Johnson county the 90-day varieties are being snapped for hogs. In many south central and southwest counties, upland corn is a failure; bottom land corn will yield only about 25 bushels; and silos are being filled early to make the most of a bad situation. A large number of silos have been built this year.

The rains have softened the ground in most sections so that plowing is progressing and a large acreage of fall wheat and rye is indicated. Tomatoes, cucumbers, sweet corn, potatoes and pastures were greatly benefited by the rains, though potatoes will be a light crop in the southern half of the state. Apples are dropping badly.

Bulletin No. 21, August 27, 1918—

Though temperatures averaged about 6 degrees above normal with maxima above 90 on two or three days, no such extreme, scorching temperatures occurred as during the preceding three weeks. Nearly all portions of the state had showers and some portions heavy local rains. In the north central counties the amounts were between one and two inches, while portions of Mahaska, Marion, Monroe and Wapello counties had from two or over three inches, accompanied by severe electrical storms and considerable damage by lightning.

Thrashing, which has been delayed by heavy rains in the northern part of the state for more than two weeks, was resumed towards the close of this week. Sprouting and molding of shocked grain is reported from many counties. Fall plowing and preparation for seeding an increased acreage of winter wheat has made good progress where moisture was sufficient.

Pastures, potatoes, gardens and the supply of stock water have improved materially in the south central counties. The rains have been inadequate in most southwest counties.

Corn has made excellent progress over the northern and eastern counties where some of it is already safe from injury from frost. Some of the replanted lowland

corn in the central and north central counties will make only fodder and silage. While the corn in the south central and southwest counties shows improvement in appearance, nothing can restore the damage done to the commercial crop. Cutting for fodder and silage is under way about a month earlier than usual in the damaged area.

Bulletin No. 22, September 3, 1918—

Heavy rains occurred in the southeast and portions of the east central and south central districts also in Hardin county. Over most of the western and northern districts the rain was very light or nil. Temperatures about 85 in the north and slightly above 90 in the south occurred on the afternoon of August 27th, after which the weather was generally cool, especially at night. The lowest temperature reported was 39 at Washta on the morning of the 31st. Traces of frost were reported in the south central counties on the mornings of the 30th and 31st.

Corn is advancing rapidly to maturity. More than half of the crop is already safe from frost in the northwest counties. By September 20th, 83 per cent of the crop will be safe in the northwest and 62 per cent in the east central districts, averaging 75 per cent for the state. By September 30th, 95 per cent will be safe in the northwest and 80 per cent in the east central, with 88 per cent for the state. By October 10th, which is about the average date of the first killing frost, 95 per cent will be safe. Though the east central counties are the latest, they are not far from normal. Silo filling is progressing in the south and has been finished in a few localities.

Shock thrashing is practically finished, except in the northern districts, where delayed by the wet weather early in August. Stacks are generally in the "sweat" and not fit to thrash. Cutting of wild hay and third-crop alfalfa is in progress. Potatoes will be less than a normal crop, and are very poor in the southwest. Pastures are improving as a result of recent rains and more moderate temperatures. A large acreage of winter grain is assured in the region of heavy rain, where the soil is working up in excellent condition.

Bulletin No. 23, September 10, 1918—

Rains, mostly light, occurred in all portions of the state. Much of that reported by correspondents fell at the close of last week. More than one inch occurred in some of the south central counties. Temperatures were generally low, averaging about six degrees below normal. The lowest reported was 35 at Washta on the 6th. Light frosts were reported in Floyd county on the morning of the 5th. The highest temperatures were generally between 80 and 87 on Sunday the 8th. Sunshine was generally deficient.

Corn made satisfactory progress in spite of the cool weather. Silo filling is about completed in the southwest where corn was prematurely ripened and is beginning in the north and east. Much is being cut for fodder. Considerable seed corn is being saved.

Plowing for winter wheat has progressed rapidly, though dry soil has made it difficult in the central and western counties. Seeding has begun in Adams, Mills, Lee and Scott counties. Much will be sown in corn ground in the southwest, from which it has been possible to remove the silage and fodder earlier than usual. Potatoes are a poor crop generally. Blight has been quite prevalent, and rot has attacked them in the northern counties where the soil has been excessively wet. Sorghum grinding has begun in Keokuk county. An excellent third crop of alfalfa and second crop of clover is being secured in the southeast counties. Pastures are in unusually good condition in the eastern one-third of the state, but stock is being fed from the cornfields in the southwest. Considerable shock thrashing remains to be done in the north.

Note: Because of a shortage of funds, due to increased cost of printing, it will be necessary to suspend the publication of this bulletin for the season. Correspondents are requested to continue reporting till October 7th. Postal card summaries will be issued if conditions warrant.

Bulletin No. 24, September 17, 1918—

Generous rains occurred in the northeast one-third of the state, the heaviest, nearly three inches, being reported in Floyd county. Cool, cloudy weather pre-

vailed, the deficiency in temperature averaging about 5 degrees and ranging from 1 degree in the southwest to 7 degrees in the northeast. Frost occurred in the northwest counties on the 12th and 16th. The lowest temperature reported was 32 degrees at Primghar.

Two weeks of abnormally cool weather and deficient sunshine have retarded the maturing of corn in most sections. Probably not more than 60 per cent of the crop is now safe from frost. Cutting of fodder and silage is progressing rapidly. Plowing is under way in all but the southwest and west central sections where the soil is so dry that only tractors can handle it and then it can not be reduced to a seed bed for winter wheat. Seeding of winter wheat has made good progress where moisture is sufficient and some is already up in Lee county.

Shock thrashing is about finished, but considerable unthrashed grain remains in stacks. Sorghum factories, though working to capacity, are unable to take care of the crop. The second crop of clover harvest has been delayed in the northeast by the heavy rains. In much of the eastern part of the state, pastures are green like spring, while in the southwest and west-central districts stock has subsisted on corn fodder the past six weeks.

Bulletin No. 25, September 24, 1918—

Abnormally low temperatures with an average daily deficiency of about 11 degrees, were accompanied by killing frost in the northwest counties on the 18th, and throughout the state on the 19th, 20th and 21st, except a distance of two or three counties west of the Mississippi River, where the frosts were light. The lowest temperature reported was 22 degrees on the 20th at Washta, Cherokee county. Ice formed in a number of places.

Dry weather favored the maturing of corn which proceeded rapidly so that 86 per cent is now safe from frost. Of the remaining 14 per cent, less than half or about 5 per cent of the total crop was seriously damaged by frost and this will be readily absorbed by feeding on the farms, so that the commercial crop of corn is practically uninfluenced by frost. With normally warm and dry weather during the next two weeks the damage as compared with last year would be negligible.

Potatoes and sugar beets were not appreciably damaged by the frost. Sweet corn was damaged slightly, but not enough to stop the canneries. Tomatoes, sweet potatoes and minor garden crops were generally killed.

The dry weather has seriously retarded the seeding and germination of winter wheat in the central and western portions of the State. Where moisture is sufficient, wheat is up and growing nicely.

IOWA CROP REPORT, JUNE 1, 1918.

Following is a summary showing the condition of crops on June 1, as compared with the average of past years on that date:

Corn, 98 per cent; oats, 101; spring wheat, 102; winter wheat, 91; barley, 101; rye, 97; flax, 98; potatoes, 101; tame hay, 86; wild hay, 91; pastures, 90; alfalfa, 95; sweet corn, 98; pop corn, 98 per cent.

The secretary of the State Horticultural Society reports the condition of fruit as follows:

Apples, 67 per cent; pears, 35; American plums, 58; Domestica plums, 40; Japanese plums, 36; cherries, 50; peaches, less than 5; grapes, 59; red raspberries, 62; black raspberries, 64; blackberries, 67; currants, 72; gooseberries, 75, and strawberries, 73 per cent of a full crop. The average of all fruits is 54 per cent, or 16 per cent below the average for the month of May, and 2 per cent below the estimate of June 1, last year, and 1½ per cent above the ten-year average.

IOWA CROP REPORT, JULY 1, 1918.

Reports received July 1, from township correspondents of the Iowa Weather and Crop Service, show the following results as to the acreage and average condition of staple farm crops:

Corn.—The acreage planted this year, after making allowances for the acreage loss by floods and washings, is 10,337,700 or 33,000 less than last year, as shown by Township Assessors. The condition was 105 per cent, or 18 per cent better than on July 1, 1917. The stand is remarkably good, considering the low vitality of the seed. This is probably due to the untiring efforts of the County Agricultural Agents and farmers in seed testing, together with unusually favorable weather and soil conditions at planting time. The crop is far advanced.

Oats.—Area seeded, 5,426,500 or 16,500 acres more than last year. Condition, 97 per cent, is 5 per cent less than last year.

Spring Wheat.—Area seeded, 580,400 acres, or an increase of 415,600 acres over last year. Condition, 101 per cent, or 2 per cent better than last year. The increase in acreage is a patriotic response of the farmers to the appeal of the State Council of Defense made through the County Agents.

Winter Wheat.—Acreage to be harvested, 197,270, or 46,172 acres more than in 1917. Condition, 92 per cent or 12 per cent better than last year.

Barley.—Acreage seeded, 340,100, increase 34,700 acres. Condition, 100 per cent, 2 per cent better than last year.

Rye.—Acreage, 50,040 which is 1636 more than last year. Condition, 96, or 2 per cent better than last year.

Flax.—Acreage, 8,687 as compared with 8,384 in 1917. Condition, 95 or 1 per cent better than last year.

Potatoes.—Acreage, 97,210 a decrease of about 3,000 acres. Condition, 97 per cent, or 9 per cent lower than last year.

Hay.—Acreage of tame and wild hay, 2,994,200, or 291,900 acres less than in 1917. Condition, 88 per cent, or 5 per cent better than last year.

Alfalfa.—Acreage, 116,040, increase, 870 acres.

Pastures.—Acreage, 9,080,400; decrease, 415,900 acres. Condition, 92 per cent, or 3 per cent below last year.

Fruit.—The Secretary of the State Horticultural Society reports the condition of fruit on July 1, as follows: "Summer apples, 32 per cent; fall apples, 36 per cent; winter apples, 38 per cent; cherries, 38 per cent; pears, 14 per cent; American plums, 37 per cent; Domestic plums, 18 per cent; Japanese plums, 9 per cent; grapes, 49 per cent; red raspberries, 60 per cent; black raspberries, 68 per cent; blackberries, 70 per cent; currants, 65 per cent; gooseberries, 70 per cent of a full crop. The average for all fruits is 48 per cent, or 9 per cent below the last 5-year average. The indications are that there will be about half as many apples and plums as last year, and about the same quantity of grapes and raspberries as in 1917."

IOWA CROP REPORT, AUGUST 1, 1918.

The condition of crops on August 1, as compared with the average of past years on that date, was as follows: Corn, 101 per cent; pastures, 89; potatoes, 86; and flax 97. Last year on August 1, the condition of corn was 92 per cent; pastures, 90; potatoes, 96; and flax, 96.

Preliminary reports show the average yield of winter wheat to be about 21 bushels per acre; spring wheat, 18; early oats, 42; late oats, 43; barley, 32; rye, 19; tame hay, 1.2 tons; and wild hay also 1.2 tons. Threshing reports received up to August 1 were mostly from the south half of the State. If final returns maintain these averages, the State will produce about 4,143,000 bushels of winter wheat; spring wheat, 9,447,000; oats, 234,876,000; barley, 10,883,000; rye, 951,000 bushels; and 3,593,000 tons of hay.

The Secretary of the State Horticultural Society reports the condition of fruit on August 1 as follows: Summer apples, 26 per cent; fall apples, 27; winter apples, 29; pears, 18; American plums, 23; domestic plums, 13; Japanese plums, 5; grapes, 52 per cent of a full crop. The percentage of crop on the eight leading varieties of commercial apples is as follows: Duchess, 26 per cent; Wealthy, 24; Grimes Golden, 32; Jonathan, 30; Winesap, 19; Ben Davis, 25; Northwestern Greening, 29; and Willow Twig, 31. There will be about half as many apples and plums, and the same quantity of grapes as were harvested last year, should normal conditions prevail until crops are gathered for market or storage.

IOWA CROP REPORT, SEPTEMBER 1, 1918.

Following is a summary showing the condition of crops on September 1, as compared with the average of past years on that date: Corn, 90 per cent; potatoes, 78; flax, 95; pastures, 85; On September 1, 1917, the conditions were: Corn, 84; potatoes, 95; flax, 94; and pastures, 80 per cent.

Hot winds and drouth seriously damaged corn in the southwest one-third of the State during the first half of August, so that the average condition September 1, was 11 per cent lower than on August 1. The total production will be about 350,000,000 bushels, or nearly 17,000,000 bushels above the ten-year average.

Preliminary reports indicate the average yield of winter wheat to be 21 bushels per acre; spring wheat, 19; oats, 43; barley, 31; rye, 18; and timothy seed, 4.6. If these estimates are maintained by final reports, the State will produce about 4,143,000 bushels of winter wheat, 11,028,000 of spring wheat; 237,640,000 of oats; 10,679,000 of barley, and 900,000 bushels of rye. The area of timothy cut for seed was 73 per cent of last year's acreage. Eighty per cent of the threshing had been finished on September 1, which is about 10 per cent above the normal.

FINAL CROP REPORT OF THE STATE, 1918.

Following is a summary of reports from crop correspondents of the Iowa Weather and Crop Service showing the average yield per acre and total yields of staple soil products, and the average price at the nearest station, December 1, 1918. This report does not include or take into consideration live stock, poultry or dairy products:

Corn.—The estimated acreage was 10,337,700, or 33,000 acres less than in 1917; average yield, 34.5 bushels per acre; total yield, 356,677,000 bushels; average price, \$1.23 per bushel; total value, \$438,712,710. Only 4 per cent of the crop was reported to be soft or immature and 91 per cent had been husked on December 1st. The crop this year is being referred to as "disappointing," yet the yield is only 2.0 bushels per acre below the average of the last 10 years and the total crop, 356,677,000 bushels has been exceeded but four times in 29 years. The quality is excellent and the feeding value of the 1918 crop is much greater than that of the 1917 crop bushel for bushel.

Oats.—The estimated area harvested was 5,426,500 acres, or about 16,500 acres more than in 1917. Average yield, 40.2 bushels; total yield, 217,592,500 bushels; average price, 64 cents; total value, \$140,043,200.

Spring Wheat.—Area harvested, 580,400 acres, or about 415,600 acres more than in 1917; average yield 18.2 bushels per acre; total yield, 10,584,600 bushels; price per bushel, \$1.99; total value, \$21,063,354.

Winter Wheat.—Area harvested, 197,270 acres; average yield per acre, 19.9 bushels; total yield 3,920,810; average price, \$2.02 per bushel; total value, \$7,920,036.

Barley.—Area harvested, 340,100 acres; average yield per acre, 31.3 bushels; total yield, 10,649,200 bushels; average price, 89c per bushel; total value, \$9,477,788.

Rye.—Area harvested, 50,040 acres; average yield, 18.1 bushels; total yield, 905,850; price per bushel, \$1.48; total value, \$1,340,658.

Flax Seed.—Average yield, 10.1 bushels; total yield, 87,450 bushels; total value, at \$3.26 per bushel, \$285,087.

Timothy Seed.—Area harvested, 156,750 acres; average yield, 4.3 bushels; total yield, 673,025; total value, at \$4.27 per bushel, \$2,873,817.

Clover Seed.—Area harvested, 23,480 acres; average yield, 1.5 bushels; total value, at \$19.74 per bushel, \$695,243.

Potatoes.—Area harvested, 97,210 acres; average yield, 76.1 bushels; total yield, 7,391,750 bushels; average price, \$1.32; total value, \$9,761,070.

Hay (Tame.)—Average yield, 1.3 tons per acre; total yield, 3,357,100 tons; average price, \$19.57 per ton; total value, \$65,697,448.

Hay (Wild).—Average yield, 1.2 tons; total yield, 594,580 tons; average price, \$16.00; total value, \$9,513,280.

Alfalfa.—Area harvested, 116,040 acres; average yield, 2.8 tons; total yield, 328,110 tons; average price, \$23.93 per ton; total value, \$7,875,602.

TABULATED CROP SUMMARY.

Crop	Acres	Average Yield	Average Price	Total Yield	Total Value
Corn -----	10,337,700	34.5 Bu.	\$ 1.23	356,677,000	\$ 438,712,710
Oats -----	5,426,500	40.1 Bu.	.64	217,592,500	140,043,200
Spring Wheat -----	580,400	18.2 Bu.	1.99	10,584,600	21,063,354
Winter Wheat -----	197,270	19.9 Bu.	2.02	3,920,810	7,920,036
Barley -----	340,100	31.3 Bu.	.89	10,649,200	9,477,788
Rye -----	50,040	18.1 Bu.	1.48	905,850	1,340,658
Flax Seed -----	8,687	10.1 Bu.	3.26	87,450	285,087
Timothy Seed -----	156,750	4.3 Bu.	4.27	673,025	2,873,817
Clover Seed -----	23,480	1.5 Bu.	19.74	35,220	695,243
Potatoes -----	97,210	76.1 Bu.	1.32	7,394,750	9,761,070
Hay (Tame) -----	2,502,620	1.3 tons	19.57	3,357,100	65,697,448
Hay (Wild) -----	491,590	1.2 tons	16.00	594,580	9,513,280
Alfalfa -----	116,040	2.8 tons	23.93	329,110	7,875,602
Pasture and Grazing (Estim'd)					90,000,000
Ensilage (Estimated)					20,000,000
Sweet Corn (Estimated)		3.0 tons	15.00		6,000,000
Pop Corn (Estimated)	18,805	19.5 Bu.	4.16	366,700	1,525,472
Buckwheat (Estimated)	16,000	15.3 Bu.	1.70	244,800	416,160
Fruit Crop (Estimated)					6,000,000
Garden Truck (Estimated)					8,500,000
Sugar Beets for Manufacture (Estimated) -----	7,000				
(Estimated) -----		10.0 tons	9.00	70,000	630,000
Miscellaneous (Estimated)					11,500,000
Total -----					\$ 859,830,915
Total value of soil products for 1917 was -----					\$ 822,061,291

IOWA CROPS, 1918, ESTIMATED NUMBER OF ACRES BY COUNTIES.

Counties	Corn	Oats	Spring Wheat	Winter Wheat	Barley	Rye	Flax	Potatoes	Tame Hay	Wild Hay	Alfalfa	Pastures
Adair-----	120,000	39,300	3,000	1,000	4,200	40	-----	820	25,200	1,560	70	117,700
Adams-----	82,100	26,900	1,900	1,600	1,200	210	-----	480	18,500	1,440	490	88,000
Allamakee-----	45,100	37,100	8,700	1,000	7,500	450	20	1,090	48,800	1,020	50	160,000
Appanoose-----	50,100	21,400	1,000	1,700	100	320	-----	290	30,600	720	50	120,000
Audubon-----	91,600	37,500	5,000	900	8,500	30	-----	780	31,800	1,980	1,040	72,600
Benton-----	147,300	85,800	2,000	200	8,000	900	-----	1,100	25,000	2,000	70	96,600
Black Hawk-----	102,900	64,100	1,000	400	4,300	1,900	5	1,610	24,600	7,500	30	87,500
Boone-----	131,900	70,400	2,000	700	1,000	50	-----	520	16,600	5,900	220	69,300
Bremer-----	60,700	47,800	2,000	200	1,300	480	-----	1,320	15,000	19,500	30	69,800
Buchanan-----	104,900	63,200	3,500	200	2,800	910	20	1,000	27,600	10,530	10	108,800
Buena Vista-----	135,700	88,000	2,000	150	1,000	40	30	1,050	18,800	7,520	760	65,300
Butler-----	95,500	75,000	3,600	50	1,100	1,090	-----	2,340	26,800	8,960	10	71,500
Calhoun-----	138,500	101,400	1,000	50	900	30	30	650	16,500	3,610	270	50,000
Carroll-----	120,300	66,800	8,600	500	2,300	20	15	1,660	22,700	6,480	450	115,200
Cass-----	129,200	39,600	7,100	3,000	10,000	230	-----	1,120	24,400	1,240	550	104,100
Cedar-----	110,100	38,800	1,700	200	13,000	560	-----	1,230	39,300	140	70	115,800
Cerro Gordo-----	98,200	73,900	3,000	50	2,100	100	90	1,290	28,700	9,970	120	74,300
Cherokee-----	124,900	78,400	1,200	50	2,400	40	-----	950	31,500	7,900	2,290	78,800
Chickasaw-----	59,800	69,000	6,200	2,000	2,500	430	105	910	21,600	11,230	10	82,500
Clarke-----	64,200	25,700	2,000	2,300	200	110	405	290	20,300	30	30	97,400
Clay-----	116,500	78,000	1,100	130	2,700	260	-----	680	6,100	13,720	650	74,800
Clayton-----	74,000	63,000	11,900	2,500	12,000	500	-----	1,050	48,200	1,260	50	157,000
Clinton-----	110,800	45,600	9,300	8,000	10,000	1,690	-----	930	40,900	1,590	100	131,400
Crawford-----	150,100	66,000	29,000	3,400	4,500	160	-----	1,420	16,400	5,240	4,130	110,800
Dallas-----	139,500	60,400	1,200	12,000	1,200	80	-----	530	43,200	2,390	350	79,600
Davis-----	59,700	22,500	1,500	2,500	100	660	-----	590	25,900	130	40	133,400
Decatur-----	72,000	25,600	1,000	3,500	100	720	-----	300	33,300	5,270	140	103,300
Delaware-----	87,100	59,600	2,300	90	8,800	1,540	-----	1,120	18,300	70	240	112,900
Des Moines-----	65,700	27,200	1,200	5,000	300	2,110	600	580	12,800	12,050	210	53,400
Dickinson-----	65,600	45,600	4,700	100	1,400	20	-----	2,110	52,800	8,350	90	144,600
Dubuque-----	67,300	51,500	9,200	500	4,400	300	-----	490	16,000	10,200	110	49,000
Emmet-----	71,800	54,900	1,500	50	1,400	130	440	1,230	53,600	4,190	20	141,500
Fayette-----	88,000	73,000	7,600	200	8,700	390	20	1,250	31,900	8,460	100	68,000
Floyd-----	89,300	70,200	3,000	50	2,100	720	115	1,520	38,400	2,230	7,650	40,500
Franklin-----	113,600	84,300	2,000	50	2,500	120	10	590	5,800	5,030	110	52,600
Fremont-----	130,100	13,100	2,000	7,200	300	340	-----	570	19,700	5,520	30	72,600
Greene-----	136,700	70,900	2,000	900	700	20	-----	1,630	23,200	3,320	280	70,000
Grundy-----	106,300	71,800	1,200	100	3,000	40	-----	720	21,700	6,100	150	100,000
Guthrie-----	110,400	46,400	3,900	1,000	1,500	20	5	1,050	21,300	21,800	110	69,200
Hamilton-----	129,400	88,700	1,000	400	1,000	20	460	1,050	23,900	5,360	110	78,800
Hancock-----	108,300	88,900	5,800	50	3,000	310	-----	940	26,200	-----	110	72,200
Hardin-----	109,000	71,500	3,300	50	2,500	100	-----	-----	-----	-----	-----	-----

IOWA CROPS, 1918, ESTIMATED NUMBER OF ACRES BY COUNTIES—Continued.

Counties	Corn	Oats	Spring Wheat	Winter Wheat	Barley	Rye	Flax	Potatoes	Tame Hay	Wild Hay	Alfalfa	Pastures
Harrison	153,300	30,300	30,000	4,300	2,600	250	-----	950	6,200	6,530	11,600	91,400
Henry	77,000	32,800	1,500	2,200	200	1,160	-----	300	25,800	10	90	92,800
Howard	54,500	56,300	2,200	200	4,900	310	295	930	35,500	11,930	10	83,400
Humboldt	95,800	66,000	1,700	150	1,800	30	75	500	16,900	5,700	210	41,000
Ida	99,600	51,700	6,700	-----	3,500	30	12	640	21,000	1,320	1,600	111,700
Iowa	96,500	49,100	3,300	800	2,000	1,600	-----	1,140	23,300	400	20	89,800
Jackson	58,500	29,100	3,300	1,600	2,600	760	-----	1,280	52,900	750	60	22,400
Jasper	159,900	65,200	12,000	2,000	800	150	15	300	29,400	500	100	115,500
Jefferson	68,200	30,900	1,600	2,000	200	710	-----	390	28,400	-----	20	93,200
Johnson	106,700	51,500	2,400	1,000	2,100	1,320	-----	1,030	38,810	550	60	113,900
Jones	72,700	37,200	5,400	500	6,400	650	-----	790	44,800	220	20	122,800
Keokuk	111,100	40,300	10,500	1,400	300	410	-----	770	35,700	40	40	120,700
Kossuth	184,400	142,600	3,700	100	3,700	100	1,560	1,800	30,900	29,340	250	114,600
Lee	59,900	24,500	1,600	2,700	500	7,630	-----	1,220	28,600	-----	220	128,200
Linn	118,200	59,200	8,000	200	3,300	670	-----	1,460	40,100	2,060	140	112,300
Louisa	65,800	25,500	1,000	7,800	-----	2,280	-----	420	15,700	150	50	70,600
Lucas	62,400	25,300	1,600	2,400	100	470	-----	440	23,200	110	60	97,800
Lyon	129,600	102,600	6,400	100	12,000	20	20	1,650	11,700	9,440	2,620	159,000
Madison	105,800	35,100	2,100	4,400	2,800	130	-----	1,040	19,500	1,460	160	122,700
Mahaska	122,900	47,500	4,300	3,300	700	420	-----	1,670	25,000	280	120	111,300
Marion	99,800	36,500	5,500	6,500	900	200	-----	440	18,800	420	110	130,700
Marshall	127,200	67,400	4,100	700	1,000	50	-----	810	26,900	440	80	85,800
Mills	108,700	18,800	7,900	3,200	1,100	160	-----	910	7,100	4,150	6,870	58,000
Mitchell	67,500	77,500	6,500	50	3,200	50	730	2,440	30,200	3,300	10	66,000
Monona	139,000	28,500	29,000	25,000	2,000	90	-----	1,250	6,800	11,800	11,260	90,200
Monroe	53,200	14,800	2,200	3,000	100	470	40	270	25,400	20	20	103,900
Montgomery	100,000	28,100	6,600	4,900	800	350	-----	640	15,300	750	2,990	77,900
Muscatine	78,400	33,500	3,600	1,600	7,600	2,540	-----	1,410	20,300	610	220	78,800
O'Brien	125,500	81,000	1,600	50	7,300	20	10	1,160	22,400	6,770	1,690	71,500
Oseola	83,700	58,600	1,500	-----	2,600	60	195	870	12,300	5,650	130	36,200
Page	124,500	25,500	2,000	12,000	400	440	-----	540	20,700	1,180	3,090	100,400
Palo Alto	100,800	68,100	3,600	50	600	300	420	630	13,400	18,000	190	58,300
Plymouth	190,800	95,700	65,000	500	5,000	300	5	1,520	20,310	22,580	10,460	103,500
Pocahontas	132,400	101,400	2,000	50	1,000	270	115	840	17,900	8,800	190	53,500
Polk	111,400	46,700	6,000	500	200	550	-----	1,100	17,200	3,000	370	70,800
Pottawattamie	219,900	64,800	12,000	1,900	12,000	510	-----	2,090	24,500	6,600	12,660	127,300
Poweshiek	123,100	50,900	3,700	400	2,300	100	-----	780	23,200	100	60	91,900
Ringgold	87,800	31,300	1,100	1,700	200	350	-----	270	30,400	160	30	112,500
Sac	129,100	81,400	2,600	50	2,900	10	20	740	23,700	4,030	450	57,900
Scott	75,700	28,400	5,600	1,500	29,000	2,270	-----	4,160	28,500	1,780	610	81,100
Shelby	128,000	47,600	14,000	300	10,000	80	-----	1,110	29,800	3,820	3,570	94,000
Sioux	176,500	97,200	21,000	500	15,000	50	-----	1,250	16,000	14,020	4,470	77,400

Story-----	142,000	67,900	2,000	300	100	30	5	190	21,500	2,730	90	60,100
Tama-----	134,300	77,300	15,000	300	10,000	220	-----	1,240	30,900	1,100	60	116,800
Taylor-----	102,100	33,000	1,500	300	300	340	-----	560	21,000	740	600	103,900
Union-----	73,800	27,000	1,400	1,200	600	60	-----	740	19,700	710	70	90,500
Van Buren-----	56,200	23,400	1,200	2,000	100	1,130	-----	160	29,300	30	190	113,800
Wapello-----	65,100	23,900	1,500	3,500	300	430	-----	970	24,800	10	170	96,000
Warren-----	101,000	32,600	3,300	10,000	600	410	-----	540	24,800	640	230	118,700
Washington-----	104,900	43,700	1,200	1,200	400	150	10	520	13,400	10	60	105,800
Wayne-----	90,600	32,900	1,200	1,000	100	140	-----	30	30,700	50	20	100,000
Webster-----	156,800	118,900	4,500	500	1,200	40	30	1,010	21,300	8,810	420	75,900
Winneshiek-----	67,000	50,700	10,000	-----	4,100	-----	810	1,340	18,800	20,080	30	52,400
Winnebago-----	77,200	67,000	15,000	600	12,000	330	190	1,310	54,000	4,570	20	138,300
Woodbury-----	200,500	72,000	25,000	5,200	2,900	70	15	1,550	17,000	8,970	15,530	103,100
Worth-----	53,400	60,200	8,000	50	3,500	140	1,520	740	29,600	15,420	80	61,800
Wright-----	112,800	81,700	1,000	100	1,600	40	215	710	24,700	6,840	100	65,100
	10,337,700	5,426,500	580,400	197,270	340,100	50,040	8,687	97,210	2,502,620	491,590	116,040	9,080,400

TABULATED CROP SUMMARY FOR THE YEAR 1918.—PART I

Counties	Corn		Oats		Spring Wheat		Winter Wheat		Barley	
	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels
Adair.....	14	1,680,000	28	1,100,500	14	42,000	15	15,000	26	109,200
Adams.....	7	575,000	27	726,500	14	26,600	15	24,000	20	24,000
Allamakee.....	46	2,075,000	41	1,521,100	21	182,700	16	16,000	27	202,500
Appanoose.....	28	1,403,000	41	877,400	20	20,000	20	34,000	25	2,500
Audubon.....	29	2,656,000	32	1,200,000	16	80,000	18	16,200	30	255,000
Benton.....	43	6,334,000	44	3,775,000	16	32,000	18	3,600	34	272,000
Black Hawk.....	38	3,910,000	44	2,820,400	18	18,000	22	8,800	35	150,500
Boone.....	35	4,616,000	43	3,027,200	16	32,000	18	12,600	34	34,000
Bremer.....	38	2,307,000	39	1,864,000	18	36,000	18	3,600	32	41,600
Buchanan.....	38	3,986,000	42	2,654,400	17	59,500	20	4,000	38	106,400
Buena Vista.....	43	5,835,000	47	4,136,000	22	44,000	26	3,900	33	33,000
Butler.....	38	3,629,000	35	2,625,000	12	43,200	16	800	24	26,400
Calhoun.....	40	5,540,000	45	4,563,000	22	22,000	18	900	40	36,000
Carroll.....	38	4,571,000	42	2,805,600	19	163,400	26	13,000	36	82,800
Cass.....	12	1,550,000	28	1,108,800	14	99,400	16	48,000	20	200,000
Cedar.....	51	5,615,000	50	1,940,000	18	30,600	23	4,600	35	455,000
Cerro Gordo.....	39	3,830,000	40	2,956,000	16	48,000	15	750	25	52,500
Cherokee.....	44	5,496,000	47	3,684,800	23	1,100	22	1,100	37	88,800
Chickasaw.....	30	1,794,000	45	3,105,000	16	99,200	-----	-----	30	75,000
Clarke.....	24	1,541,000	34	873,800	17	34,000	16	36,800	35	7,000
Clay.....	42	4,893,000	47	3,666,000	17	18,700	20	2,600	34	91,800
Clayton.....	43	3,182,000	38	2,394,000	24	285,600	19	47,500	37	444,000
Clinton.....	44	4,875,000	43	1,960,800	18	167,400	19	152,000	33	330,000
Crawford.....	28	4,203,000	40	2,640,000	21	609,000	26	88,400	32	144,000
Dallas.....	29	4,046,000	46	2,778,400	18	21,600	21	252,000	35	42,000
Davis.....	34	2,030,000	46	1,035,000	19	28,500	21	52,500	32	3,200
Decatur.....	18	1,296,000	36	921,600	17	17,000	18	63,000	15	1,500
Delaware.....	30	2,613,000	42	2,503,200	15	34,500	20	1,800	25	220,000
Des Moines.....	50	3,285,000	44	1,196,800	21	25,200	24	120,000	28	8,400
Dickinson.....	37	2,427,000	41	1,869,600	15	90,500	20	2,000	33	46,200
Dubuque.....	42	2,827,000	43	2,214,500	21	193,200	20	10,000	38	167,200
Emmet.....	41	2,944,000	45	2,470,500	16	24,000	20	1,000	35	49,000
Fayette.....	40	3,520,000	47	3,431,000	20	152,000	25	5,000	33	287,000
Floyd.....	38	3,393,000	36	2,527,200	16	48,000	19	950	32	67,200
Franklin.....	35	3,976,000	42	3,540,600	17	34,000	20	1,000	26	65,000
Fremont.....	21	2,733,000	25	327,500	13	26,000	20	144,000	20	6,000
Greene.....	37	5,058,000	37	2,590,000	14	28,000	14	12,600	35	24,500
Grundy.....	36	3,827,000	37	2,656,600	13	15,600	16	1,600	32	96,000
Guthrie.....	26	2,870,000	31	1,438,400	16	62,400	20	20,000	25	37,500
Hamilton.....	34	4,400,000	40	3,548,000	17	17,000	14	5,600	29	29,000
Hancock.....	36	3,899,000	44	3,905,600	17	98,600	12	600	34	102,000
Hardin.....	37	4,033,000	42	3,003,000	16	52,800	16	800	30	75,000
Harrison.....	18	2,759,000	34	1,030,200	16	480,000	18	77,400	16	41,600
Henry.....	45	3,465,000	47	1,541,600	20	30,000	25	55,000	34	6,800
Howard.....	23	1,254,000	25	1,407,500	15	33,000	21	4,200	19	93,100
Humboldt.....	42	4,024,000	47	3,102,000	19	32,300	19	2,850	35	63,000
Ida.....	35	3,486,000	43	2,223,100	21	140,700	24	960	30	105,000
Iowa.....	33	3,184,000	37	1,816,700	18	59,400	20	16,000	29	58,000
Jackson.....	48	2,808,000	42	1,222,200	18	59,400	18	28,800	29	75,400
Jasper.....	41	6,556,000	42	2,738,400	20	240,000	21	42,000	29	23,200
Jefferson.....	42	2,864,000	45	1,390,500	18	28,800	19	38,000	36	7,200
Johnson.....	48	5,122,000	46	2,369,000	19	45,600	24	24,000	37	56,700
Jones.....	45	3,272,000	40	1,488,000	15	81,000	18	9,000	30	193,000
Keokuk.....	43	4,777,000	41	1,652,000	20	210,000	25	35,000	32	9,600
Kossuth.....	39	7,192,000	42	5,989,200	18	66,600	12	1,200	35	129,500
Lee.....	41	2,446,000	39	955,500	21	33,600	23	62,100	27	13,500
Linn.....	42	4,964,000	52	3,078,400	19	152,000	17	3,400	35	115,500
Louisa.....	45	2,961,000	45	1,147,500	15	15,000	24	187,200	-----	-----
Lucas.....	30	1,872,000	39	986,700	18	28,800	24	57,600	32	3,200
Lyon.....	42	5,443,000	43	44,100	20	128,000	20	2,000	33	396,000
Madison.....	16	1,693,000	36	1,263,600	14	29,400	19	83,600	26	42,800
Mahaska.....	36	3,424,000	47	2,232,500	17	73,100	20	66,000	35	24,500
Marion.....	31	3,094,000	42	1,533,000	18	99,000	18	117,000	31	27,900
Marshall.....	44	5,597,000	42	2,830,800	17	69,700	19	13,300	38	38,000
Mills.....	18	1,957,000	24	451,200	13	102,700	14	44,800	20	22,000
Mitchell.....	37	473,000	49	3,797,500	19	123,500	20	1,000	31	99,200
Monona.....	30	4,170,000	39	1,111,500	19	551,000	21	525,000	32	64,000
Monroe.....	29	1,543,000	43	636,400	20	44,000	21	63,000	30	3,000
Montgomery.....	17	1,700,000	30	8,400	15	99,000	16	78,400	30	24,000
Muscatine.....	43	3,371,000	40	1,340,000	18	64,800	25	40,000	26	197,600
O'Brien.....	45	5,648,000	43	3,483,000	19	30,400	21	1,000	34	248,200

TABULATED CROP SUMMARY FOR THE YEAR 1918—PART I—Continued.

Counties	Corn		Oats		Spring Wheat		Winter Wheat		Barley	
	Bushels per acre	Total Bushels	Bushels per acre	Bushels per acre	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Tons per acre	Total Tons
Osceola.....	41	3,432,000	47	2,754,200	17	15,500	18	216,000	37	96,200
Page.....	17	2,116,000	28	714,000	13	26,000	18	800	16	6,400
Palo Alto.....	45	4,536,000	42	2,860,200	11	39,600	15	11,000	35	21,000
Plymouth.....	37	7,050,000	35	3,349,500	18	1,170,000	22	1,100	31	155,000
Pocahontas.....	40	5,296,000	44	4,461,600	16	32,000	22	104,000	35	35,000
Polk.....	37	4,122,000	47	2,194,900	20	120,000	20	34,200	30	6,000
Pottawattamie.....	21	4,618,000	34	2,203,200	16	192,000	18	7,600	29	348,000
Poweshiek.....	39	4,801,000	42	2,137,800	16	59,200	19	30,600	38	87,400
Ringgold.....	17	1,493,000	35	1,095,500	15	16,500	18	1,100	20	4,000
Sac.....	38	4,906,000	52	4,232,800	22	57,200	22	36,000	38	110,200
Scott.....	50	3,785,000	48	1,363,200	21	117,600	24	4,500	35	1,015,000
Shelby.....	21	2,688,000	32	1,523,000	22	308,000	15	9,500	32	320,000
Sioux.....	42	7,413,000	44	4,276,800	19	399,000	19	6,300	33	495,000
Story.....	36	5,112,000	41	2,783,900	16	32,000	21	5,700	40	4,000
Tama.....	45	6,044,000	44	3,401,200	19	285,000	19	48,000	33	330,000
Taylor.....	18	1,838,000	28	924,000	15	22,500	16	16,800	22	6,600
Union.....	21	1,550,000	35	94,500	15	21,000	14	44,000	18	10,800
Van Buren.....	39	2,192,000	39	522,600	18	21,600	22	80,500	20	2,000
Wapello.....	32	2,083,000	41	979,900	22	33,000	23	200,000	35	10,500
Warren.....	27	2,727,000	40	1,304,000	17	56,100	20	12,800	39	23,400
Washington.....	45	4,720,000	40	1,748,000	20	24,000	19	18,000	33	13,200
Wayne.....	24	2,174,000	39	1,283,100	16	19,200	18	11,000	15	1,500
Webster.....	38	5,958,000	45	5,350,500	21	94,500	22	300	36	43,200
Winnebago.....	46	3,082,000	44	2,230,800	15	150,000	16	12,600	33	135,300
Winneshiek.....	40	3,088,000	40	2,680,000	21	315,000	21	93,600	30	360,000
Woodbury.....	37	7,418,000	38	2,736,000	18	450,000	18	900	25	72,500
Worth.....	35	1,869,000	39	2,347,800	22	176,000	18	1,500	32	112,000
Wright.....	37	4,174,000	39	3,186,300	18	18,000	15		33	52,800
	34.5	356,677,000	40.1	217,592,500	18.2	10,584,600	19.9	3,920,810	31.3	10,649,200

TABULATED CROP SUMMARY FOR THE YEAR 1918.—PART II

Counties	Rye		Flax Seed		Potatoes		Hay—Tame		Hay—Wild		Alfalfa	
	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Tons per acre	Total Tons	Tons per acre	Total Tons	Tons per acre	Total Tons
Adair.....	10	400	---	---	17	13,900	0.5	12,600	0.5	780	1.5	100
Adams.....	18	3,780	---	---	42	20,200	0.4	7,400	0.5	720	1.8	880
Allamakee.....	18	8,100	12	240	97	105,700	2.0	97,600	1.5	1,530	2.0	100
Appanoose.....	20	6,400	---	---	70	20,300	1.0	30,600	1.2	860	1.2	60
Audubon.....	22	660	---	---	73	56,900	0.8	20,000	1.1	2,180	2.0	2,080
Benton.....	20	18,000	---	---	70	77,000	1.6	50,900	1.5	3,000	3.0	210
Black Hawk.....	12	22,800	12	60	75	120,800	1.2	29,500	1.0	7,500	3.0	90
Boone.....	25	1,200	---	---	53	27,600	1.0	16,600	0.8	4,720	2.2	480
Bremer.....	19	9,100	---	---	92	121,400	1.7	18,000	1.1	21,450	3.0	90
Buchanan.....	19	17,290	12	240	116	116,000	1.3	35,900	1.2	12,640	3.0	30
Buena Vista.....	20	800	12	360	62	65,100	1.2	22,600	1.3	9,780	2.8	730
Butler.....	15	15,000	---	---	60	140,400	1.2	32,200	1.1	9,860	3.0	30
Calhoun.....	20	600	12	360	47	30,600	1.3	21,400	1.0	3,600	2.5	680
Carroll.....	20	400	12	180	75	124,500	1.2	27,200	1.2	7,780	4.0	1,800
Cass.....	9	2,070	---	---	20	22,400	0.5	12,200	0.5	620	1.5	820
Cedar.....	33	18,480	---	---	78	95,900	1.8	70,700	1.8	250	4.0	280
Cerro Gordo.....	31	3,100	12	1,080	109	140,600	1.6	45,900	1.2	11,970	5.0	600
Cherokee.....	20	800	---	---	108	102,600	1.4	31,800	1.0	7,900	3.0	6,900
Chickasaw.....	20	8,600	12	1,260	115	104,600	1.8	56,700	1.5	16,840	3.0	30
Clarke.....	17	1,870	---	---	90	26,100	0.8	17,300	1.0	30	1.5	40
Clay.....	---	---	10	4,050	65	44,200	1.5	30,400	1.5	20,580	3.5	2,280
Clayton.....	21	10,500	---	---	72	75,600	1.5	9,200	1.5	1,890	3.0	150
Clinton.....	19	32,110	---	---	64	59,500	1.4	67,500	1.5	2,380	3.6	360
Crawford.....	23	3,680	---	---	61	86,600	1.5	61,400	1.2	6,290	2.8	11,560
Dallas.....	20	1,600	---	---	41	21,700	1.3	21,300	1.3	3,110	2.7	940
Davis.....	12	7,920	---	---	79	46,600	1.3	56,200	---	---	1.2	50
Decatur.....	12	8,640	---	---	42	12,600	0.7	18,100	0.7	90	1.5	210
Delaware.....	20	30,800	---	---	50	56,000	0.8	26,600	1.5	7,900	3.0	180
Des Moines.....	21	44,300	---	---	100	72,000	1.4	25,600	1.4	100	3.0	720
Dickinson.....	16	320	9	5,400	95	55,100	1.6	20,500	1.1	13,260	3.0	630
Dubuque.....	19	5,700	---	---	85	179,400	1.3	68,600	1.4	8,400	3.0	270
Emmet.....	23	2,990	13	5,700	82	40,200	1.3	20,800	1.2	10,020	3.0	320
Fayette.....	22	8,580	5	160	92	113,200	1.8	96,500	1.2	12,240	3.0	120
Floyd.....	17	12,240	5	580	103	128,800	1.7	54,200	0.9	3,770	3.0	60
Franklin.....	15	1,800	12	120	89	135,300	1.5	57,600	1.1	9,310	3.0	300
Fremont.....	15	5,100	---	---	32	18,900	1.2	7,000	1.5	3,340	3.2	24,480
Greene.....	30	600	---	---	51	29,100	1.0	19,700	0.8	4,020	2.5	2,750
Grundy.....	22	880	---	---	51	83,100	1.5	34,800	1.0	5,520	3.0	90
Guthrie.....	18	360	12	60	36	22,700	1.0	21,700	1.1	3,650	2.8	780
Hamilton.....	22	440	11	110	58	41,800	1.0	21,300	1.0	6,100	3.0	450
Hancock.....	25	7,750	11	5,060	125	131,200	1.3	31,100	1.2	26,160	3.0	330
Hardin.....	15	1,500	---	---	55	51,700	1.4	36,700	1.0	5,360	5.0	550
Harrison.....	35	8,750	---	---	53	50,400	1.0	6,200	1.6	10,450	2.8	32,480
Henry.....	18	20,880	---	---	89	26,700	2.0	51,600	2.0	20	3.0	270
Howard.....	16	4,960	8	2,360	70	65,100	1.5	53,200	1.0	11,930	3.0	30
Humboldt.....	25	750	12	900	95	47,500	1.1	18,600	0.9	5,130	2.2	460
Ia.....	20	600	12	140	63	40,300	1.4	29,400	1.1	1,450	2.7	4,320
Iowa.....	20	32,000	---	---	52	59,300	1.6	37,300	0.5	200	2.0	60
Jackson.....	19	14,440	---	---	150	192,000	1.5	79,400	1.5	1,120	2.5	150
Jasper.....	45	6,750	12	180	64	51,200	1.2	35,300	1.5	7,500	4.0	400
Jefferson.....	14	9,940	---	---	101	39,400	1.9	54,000	---	---	3.2	60
Johnson.....	20	26,400	---	---	76	78,300	1.6	62,100	1.0	550	3.0	180
Jones.....	10	6,500	---	---	85	67,150	2.0	89,600	2.0	440	3.2	60
Keokuk.....	19	7,800	---	---	78	60,100	1.7	60,700	1.7	70	3.2	130
Kossuth.....	25	2,500	9	14,040	92	165,600	1.4	43,300	1.0	29,340	3.0	750
Lee.....	18	137,340	---	---	84	102,500	1.4	40,000	---	---	2.7	620
Linn.....	23	15,410	---	---	62	90,500	1.3	52,100	1.2	2,470	3.0	420
Louisa.....	17	38,760	---	---	112	47,000	1.5	23,600	1.4	210	5.0	250
Lucas.....	18	8,460	---	---	52	22,900	1.1	25,500	1.0	110	3.0	180
Lyon.....	10	200	14	280	107	176,600	1.4	16,400	1.3	12,270	2.7	7,070
Madison.....	18	2,340	---	---	42	43,700	0.8	15,600	0.8	1,170	2.2	350
Mahaska.....	16	6,720	---	---	82	136,900	1.4	35,000	1.5	420	3.0	360
Marion.....	23	4,600	---	---	64	28,200	1.0	18,800	1.0	420	3.0	330
Marshall.....	25	1,350	---	---	78	63,200	1.4	37,700	1.3	570	3.0	240
Mills.....	21	3,360	---	---	50	45,500	1.2	8,500	1.0	4,150	2.5	17,180
Mitchell.....	20	1,000	16	11,680	152	370,900	1.8	54,400	1.1	3,630	3.0	30
Monona.....	25	2,250	---	---	62	77,500	1.2	8,200	1.3	15,340	3.0	33,780
Monroe.....	18	8,460	12	480	70	18,900	0.8	20,300	1.0	20	3.0	60
Montgomery.....	18	6,300	---	---	42	26,900	0.7	10,700	1.1	820	2.3	6,880
Muscatine.....	13	33,020	---	---	55	77,600	1.5	30,400	1.1	670	4.2	920
O'Brien.....	10	200	10	100	90	104,400	1.5	33,000	1.2	8,120	4.2	7,100

TABULATED CROP SUMMARY FOR THE YEAR 1918—PART II—Continued.

Counties	Rye		Flax Seed		Potatoes		Hay—Tame		Hay—Wild		Alfalfa	
	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Tons per acre	Total Tons	Tons per acre	Total Tons	Tons per acre	Total Tons
Osceola.....	10	600	10	1,950	130	113,100	1.7	20,900	1.3	9,600	5.0	650
Page.....	18	7,920			26	14,000	0.7	14,500	0.9	1,060	1.8	5,560
Palo Alto.....	24	7,200	7	2,940	62	39,100	1.0	13,400	1.0	18,000	3.2	610
Plymouth.....	20	6,000			86	130,700	1.5	30,500	1.4	31,610	3.0	31,380
Pocahontas.....	25	6,750	12	1,380	57	47,900	1.1	19,700	0.9	7,920	2.0	380
Polk.....	20	11,000			58	63,800	1.2	20,600	1.0	3,000	2.6	960
Pottawattamie.....	15	7,650			51	106,600	1.1	27,000	1.1	7,260	2.4	30,380
Poweshiek.....	20	2,000			60	46,800	1.7	39,400	1.2	120	2.0	120
Ringgold.....	14	4,900			55	14,800	0.6	18,200	1.2	190	1.2	40
Sac.....	20	200			54	40,000	1.3	30,800	1.5	6,040	2.7	1,220
Scott.....	20	45,400			86	357,800	1.8	51,300	1.3	2,310	3.6	2,200
Shelby.....	28	2,240			40	44,400	0.5	14,900	1.0	3,820	2.5	8,920
Sioux.....					120	150,000	1.7	27,200	1.4	19,630	2.8	12,520
Story.....	28	840	12	60	87	16,500	1.1	23,600	0.7	1,910	2.6	230
Tama.....	25	5,500			60	74,400	1.4	43,300	1.4	1,540	3.0	180
Taylor.....	10	3,400			27	15,100	1.0	21,000	.05	370	1.0	600
Union.....	27	1,020			39	28,900	0.7	13,800	1.0	716	1.6	120
Van Buren.....	16	18,080			66	10,600	1.2	35,200	1.5	40	2.2	420
Wapello.....	23	9,890			54	52,400	0.9	22,300	1.5	20	2.2	370
Warren.....	20	8,200			43	23,200	1.1	27,300	2.5	1,000	3.0	690
Washington.....	18	2,700	10	120	90	46,800	1.5	20,100	1.7	20	3.1	190
Wayne.....	18	2,520			57	1,700	0.9	27,600	1.0	50	2.5	50
Webster.....	25	1,000	14	420	49	49,500	1.4	29,800	1.3	11,450	1.5	630
Winnebago.....	25	500	12	9,720	118	158,100	1.7	32,000	1.3	26,100	4.0	120
Winneshiek.....	23	7,590	12	2,280	121	158,500	1.9	102,600	1.5	8,860	2.0	40
Woodbury.....	19	1,330	12	180	73	11,300	1.7	28,900	1.1	10,870	3.3	51,250
Worth.....	10	1,400	7	10,640	138	102,100	1.5	44,400	1.0	15,420	3.0	240
Wright.....	18	720	12	2,580	88	62,500	1.7	42,000	1.4	9,580	3.1	310
	18.1	905,850	10.1	87,450	76.1	7,394,750	1.3	3,357,100	1.2	594,580	2.8	329,110

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